#1 Harvey [illegible]
#2. H. L. Hackl
#3 T. J. Ruby
4 Dr THOMAS
5
6 M J Bartell – office copy
7 Hanks' Ditch
8 Tom MEANS
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10 D.H.K. May 1950
11 Roy Meikle

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# COYOTE CREEK

## AND ITS RELATION TO THE

# GROUND WATER OF THE COYOTE VALLEY

## SANTA CLARA COUNTY, CALIFORNIA.

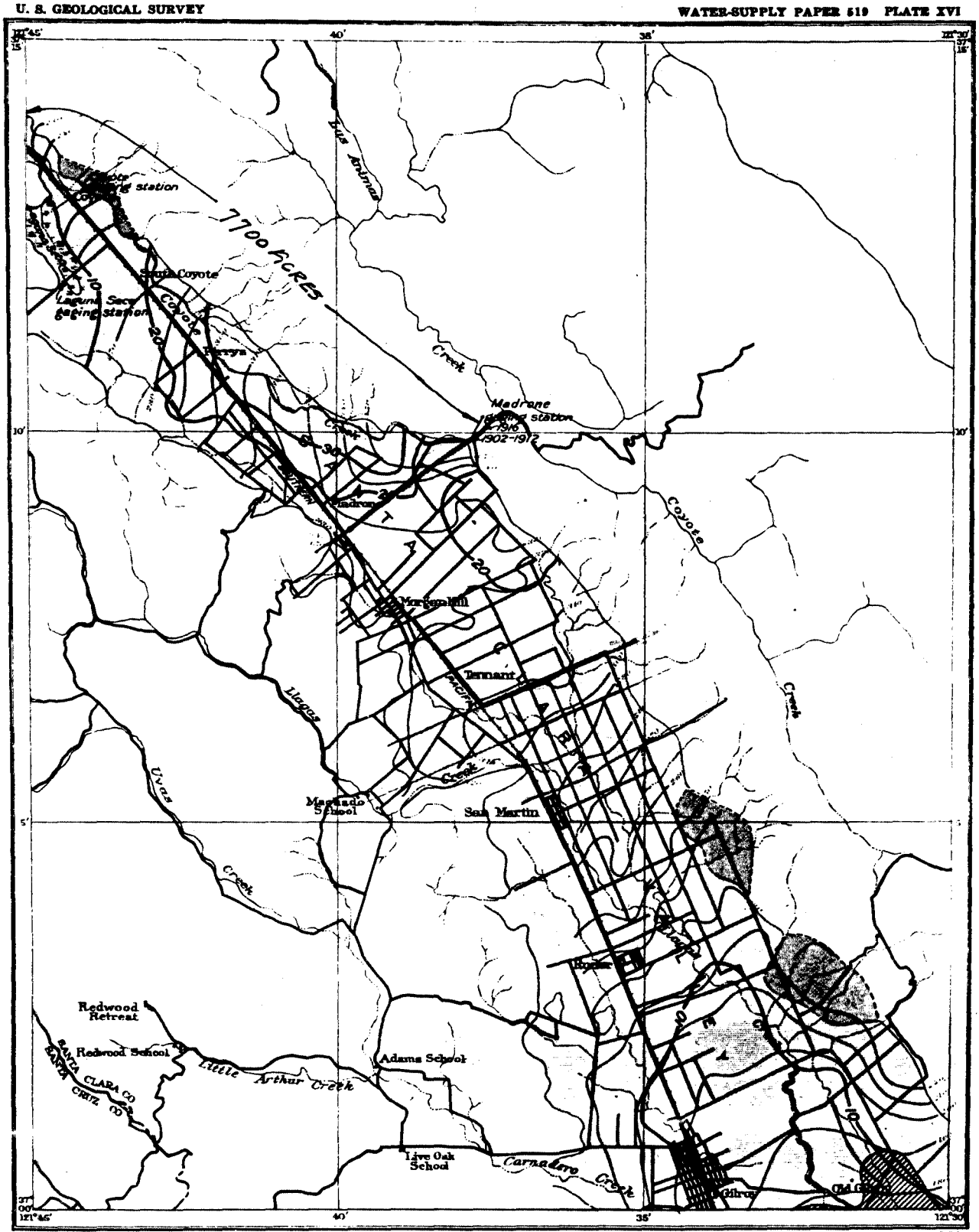
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**M. J. BARTELL,** HYDRAULIC ENGINEER.

**APRIL, 1937.**

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## EXPLANATION

- Later alluvium and related deposits
- Earlier alluvium (*Mapped on edge of Santa Clara Valley only*)
- Approximate area of artesian flow
- Contour of water table at high stage (*Interval 10 feet Datum is mean sea level*)
- 10 — Fluctuation of water table in feet

# MAP OF MORGAN HILL AREA, CALIFORNIA

## Showing ground-water conditions

Scale 1/125,000

1 ½ 0 1 2 3 4 Miles

1 ½ 0 1 2 3 4 5 Kilometers

1924

# Coyote Creek and its relation to the Ground Water in the Coyote Valley, Santa Clara County, California.

M. J. Bartell, Hydraulic Engineer, April 1937.

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This study is made for the purpose of estimating the effect, so far as possible, of the operation of the Coyote Reservoir and Diversion Canal of the Santa Clara Valley Conservation District upon the underground water supply of the Coyote Valley. The pertinent data is rather limited and to some extent incomplete, so that no definite conclusions can be made, but the information is sufficient to give a fairly clear idea of the controlling factors and conditions and a fairly good idea of the limits to which controlled flow may be exercised without interfering with the ground water replenishment of the Coyote Valley. To this end the study is a general analysis of the problem, and no definite conclusions are intended.

Coyote Valley, as herein considered, is that portion of the Santa Clara Valley lying between the Cochran Road, just south of the town of Madrone, and the town of Coyote. It is about 6-1/2 miles in length, 1-1/2 miles in width and embraces about 7,700 acres of very rich agricultural land, devoted principally to the raising of prunes. The value of this land is from $200.00 to $600.00 per acre, making $3,000,000.00 a conservative estimate of the agricultural value of the area. It is a semi-arid region, having a mean annual rainfall of from 15 to 20 inches, and practically all of the tree crops require from one to two irrigations per season. Water supply for both domestic and irrigation use is derived by means of deep wells from the underlying ground water storage. The ground water is fed by seepage from the stream channel of the Coyote Creek, which flows along the easterly rim of the valley.

Coyote Creek receives its flow from a drainage area of about 198 square miles above the U.S.G.S. Gauging Station near Madrone. At this point the stream emerges from the hills and enters the valley. Here, due to the flatter gradient of the valley, the stream velocities are reduced, compelling a deposition of some of its burden of clays, sands and gravels carried down by the higher velocities, and forming a typical cone or fan, not unlike the Niles cone or the Livermore Valley. The annual burden of sands, clays and gravels thus deposited, supplemented by the material washed down from the surrounding hills, has filled the valley, forming the somewhat level area as we see it today. The Coyote Creek fan, or cone, embraces roughly the area from the town of Tennant to the town of Coyote, but

the surface flow of the stream has long since abandoned the portion of the fan from Madrone south, and now flows along the higher edge of the northerly half of the fan which comprises the Coyote Valley. Such, very briefly and sketchily, is the geological history of the formation of the Coyote Valley, insofar as it is of interest to this study.

The Valley fill, composed of sand, clay and gravel, is relatively porous, affording ready means of entry and storage for underground water. The creek flowing along the easterly and higher edge of the Valley loses, by seepage through the porous gravels forming the channel, a considerable portion of its flow. This seepage, augmented to some extent by local drainage, is the source of supply for the ground water of the Valley. The ground water, while generally referred to as storage, is in reality an underground flowing stream, flowing with the slope of the Valley from Madrone toward Coyote, where, at a narrow gorge about 1/2 mile north of Coyote, it drains underground from the Valley. This narrow gorge is locally known as the Lower Gorge in distinction from the Upper Gorge, where the Coyote Creek cuts through the hills to enter the Coyote Valley. In this respect the Coyote Valley ground water differs from that of the Livermore Valley or the Niles Cone of Alameda Creek.

The lower rim of the Niles cone, and likewise the lower end of the Livermore Valley, is covered by a thick layer of impervious clay, which like a reservoir dam, confines the underground storage and prevents its escape. The water thus definitely confined remains permanently in storage until removed by artificial means.

With the continuous outflow at the Lower Gorge, the ground waters of the Coyote Valley are not in storage, as in the Niles Cone or Livermore Valley, and they are in practically every sense comparable to a surface flowing stream; commencing to recede when the percolating supply from the Coyote Creek falls below the rate of outflow at the Lower Gorge, and continuing to fall in successive years, until the annual replenishment is equal to, or in excess of, the outflow. The gravels here serve, not as a storage basin, but merely to retard or slow down the flow of the ground water in transit to the point of outflow at the Lower Gorge. "Outflow", as here used, is intended to include, in addition to the underground outflow at the Lower Gorge, irrigation pumpage and seepage and evaporation in the Laguna Seca Area.

The following data is taken from U.S.G.S. Water Supply Paper 519, and subsequent U.S.G.S. publications, giving flow records on the Coyote Creek:

Table 1 shows the flow of Coyote Creek, as measured by the United States Geological Survey, at the Upper Gorge near Madrone where the stream enters the Valley, at Coyote about 1/2 mile south of the Lower Gorge and at a point farther down stream near the town of Edenvale. The gaugings at the several stations are for the following periods:

| | |
|---|---|
| Upper Gorge | 1917-1936 incl. |
| Coyote | 1917-1923 incl. |
| Edenvale | 1917-1936 incl. |

ACRE FEET

STATE BUL #5 p 254

50 SEAS @ 80,100 = 4005,000 AC. FT — 1871-72 — 1920-21

50 SEAS 4005,000
201 400 DEDUCT 1916-17 — 1926-27

45 SEAS 3803 600
20 " 651 268 ADD 1916-17 — 1935-36
65 " 4454 868

MEAN 68500

4454 868
176 830 ADD (37-39) 3 SEAS

68 SEAS 4631 698

68 000

1742 000 DEDUCT 1871-72 — 1890-91 (20 SEAS)

2889 698

1892-93 — 1938-39

48 SEAS 60202

TABLE II

COYOTE RIVER, SANTA CLARA COUNTY, CALIFORNIA

SEASONAL SEEPAGE LOSS UPPER GORGE (MADRONE) TO COYOTE AND TO EDENVALE

U. S. G. S. RECORD EXCEPT AS NOTED

ACRE FEET

| Season Oct. to Sept. Inc. | Madrone | Coyote | Edenvale | Loss Madrone to Coyote | Loss Madrone to Edenvale | Loss Coyote as a % of Edenvale |
|---|---|---|---|---|---|---|
| | Col.1 | Col.2 | Col.3 | Col. 4 | Col.5 | Col.6 |
| 16 — 17 | 67,900 | 53,200 | 51,400 | 14,700 | 16,500 | 89.1 |
| 17 — 18 | 12,200 | 4,140 | 2,620 | 8,060 | 9,580 | 84.1 |
| 18 — 19 | 46,400 | 27,500 | 24,800 | 18,900 | 21,600 | 87.5 |
| 19 — 20 | 14,000 | 4,000 | 2,570 | 10,000 | 11,430 | 87.5 |
| 20 — 21 | 56,800 | 29,600 | 24,800 | 27,200 | 32,000 | 85.0 |
| 21 — 22 | 69,100 | 59,200 | 56,900 | 9,900 | 12,200 | 81.1 |
| 22 — 23 | 50,700 | 37,600 | 35,500 | 13,100 | 15,200 | 86.2 |
| 23 — 24 | 878 | a 123 | 0 | b 755 | 878 | |
| 24 — 25 | 13,200 | a 5,650 | 4,420 | b 7,550 | 8,780 | |
| 25 — 26 | 40,300 | a25,080 | 22,600 | b15,220 | 17,700 | |
| 26 — 27 | 53,330 | a35,850 | 33,000 | b17,480 | 20,330 | |
| 27 — 28 | 22,500 | a12,950 | 11,400 | b 9,550 | 11,100 | |
| 28 — 29 | 7,250 | a 1,660 | 750 | b 5,590 | 6,500 | |
| 29 — 30 | 20,100 | a10,580 | 9,030 | b 9,520 | 11,070 | |
| 30 — 31 | 1,670 | a 230 | 0 | b 1,440 | 1,670 | |
| 31 — 32 | 69,800 | a58,280 | 56,400 | b11,520 | 13,400 | |
| 32 — 33 | 8,110 | a 2,990 | 2,160 | b 5,120 | 5,950 | |
| 33 — 34 | 10,700 | a 3,800 | 2,680 | b 6,900 | 8,020 | |
| 34 — 35 | 32,020 | a16,330 | 13,780 | b15,690 | 18,240 | |
| 35 — 36 | 54,310 | a30,161 | 26,230 | b24,149 | 28,080 | |
| Total 20 Yrs. | 651,268 | 418,924 | 381,040 | 232,344 | 270,228 | |
| Mean | 32,563 | 20,946 | 19,052 | 11,617 | 13,511 | 86.0 |
| % of Total flow | 100 | 64.3 | 58.5 | 35.7 | 41.5 | |
| Total 1917-23 | 317,100 | 215,240 | 198,590 | 101,860 | 118,510 | |
| 7 Yr. mean | 45,300 | 30,749 | 28,370 | 14,551 | 16,930 | 86.0 |
| % of Total Flow | 100 | 68.0 | 62.6 | 32.0 | 37.4 | |
| Total 1924-36 | 334,168 | 203,684 | 182,450 | 130,484 | 151,718 | |
| 13 Yr. Mean | 25,705 | 15,668 | 14,035 | 10,037 | 11,670 | 86.0 |
| % of Total Flow | 100 | 61.0 | 54.6 | 39.0 | 45.4 | |

a Estimated

b Estimated as 86% of loss to Edenvale

M. J. BARTELL
Hydraulic Engineer
March, 1937

From these data the seepage losses, Madrone to Coyote, and Madrone to Edenvale, were calculated. As above noted, streamflow measurements at Coyote were made only during the 7 seasons, 1917 to 1923 inclusive, and the seepage losses from the Coyote Creek, Madrone to Coyote, can only be directly calculated for this period.

This study is concerned principally with the water supply of the Coyote Valley, and it is therefore desirable to have some expression of the losses, Madrone to Coyote, for the entire period. It is to be expected that for similar periods the losses, Madrone to Coyote, should be rather closely related to the losses, Madrone to Edenvale. Column 6 Table I shows the very close relation of these losses to each other. For the 7 seasons, 1917 to 1923 inclusive, shown next from the bottom in the Table, the sum total of the losses, Madrone to Coyote, are 86% of the total losses, Madrone to Edenvale. For the individual seasons the extreme variation is from 81% for 1922 to 89% for 1917. For the period of the missing record, 1924 to 1936 inclusive, the loss, Madrone to Coyote, has been calculated by taking, for each season, 86% of the measured loss, Madrone to Edenvale, and the losses so calculated, shown in Column 4, were subtracted from the total flow at Madrohe (Column 1) to supply the missing portion of the record, "Flow at Coyote", as shown in Column 2.

Insofar as the Coyote Valley is concerned, the flow at Coyote, as shown in Column 2, is the total amount of water that would have been available for appropriation and diversion below Coyote. It should be clearly understood that the total flow at Coyote, as here shown, is available for future appropriation and diversion from the stream at some point below Coyote only. It will be shown later that considerable flow past Coyote is always necessary to insure the natural percolation between Madrone and Coyote. Some portion of the natural flow past Coyote can be conserved by means of storage, but the greater portion of such storage must be passed down the natural channel to accomplish the natural total percolation. This is more fully presented hereinafter

For the twenty year period the average seasonal flow at Coyote is 20,900 acre feet, not all of which could be conserved by the 30,000 acre foot reservoir on the upper Coyote Creek. There would be considerable waste in years like 1917, 1922, 1932, etc. The minimum for seasons like 1924 and 1931 was probably zero, but it was calculated, as above described, merely to preserve the consistency of the record. For the 17 seasons, 1918 to 1934, there are eight seasons, or 47% of the period when there was little or no water available for conservation and use elsewhere, as the following table shows.

TABLE II - (See Column 2 Table I)

| YEAR | MINIMUM FLOW AT COYOTE | | LOSS MADRONE TO COYOTE |
|---|---|---|---|
| | | A C R E F E E T | |
| 1918 | 4140 | | 8060 |
| 1920 | 4000 | | 10000 |
| 1924 | 123) | | 755 |
| 1925 | 5650) | 5773 | 7550 |
| 1929 | 1660 | | 5590 |
| 1931 | 230 | | 1440 |
| 1933 | 2990) | | 5120 |
| 1934 | 3800) | 6790 | 6900 |

The extreme cases are for the two year periods 1924 and 1925 and 1933 and 1934 as shown.

Diagram No. 1 shows in graphical form the elevation of the water for 10 wells in the area Madrone to Coyote. For each season the average high and low elevation has been calculated for the 10 wells, and also for 9 wells, excluding the well of highest water #711. In the well group given there are no wells at or near Coyote, the lower end of the area, and it would appear therefore that the 9 well average more nearly represents the average for the entire Coyote Valley. Both the 9 and 10 well averages are shown by somewhat heavier lines than the regular well records.

The records cover the period, Nov. 1914 to May 1920, and as the diagram shows they are quite fragmentary. Some estimating was necessary to preserve the consistency of the 10 and 9 year averages shown. The legend inadvertently omitted from the drawing is:

o (small circle) date and elevation of ground water
...(dotted line) indicates missing record
---(dashed line) estimated record.

SEASONAL SEEPAGE NECESSARY TC HOLD WATER TABLE IN THE COYOTE VAILEY CONSTANT.

In the following discussion the average rise and fall as shown by the 9 well average will be used as the mean for the entire valley, rather than the 10 well average, for reasons above given.

Referring to the diagram, it will be noted that for the periods of falling water table, the rates of fall as indicated by the straight lines connecting high to low water, is fairly uniform; particularly the 1917, 1919 periods.

In comparing these two periods of fall it is necessary to take into consideration the amount of seepage flow added to the ground water during the period of fall, or after the date of high water. Seepage water added during a falling period prevents or delays fall in direct proportion to the amount added.

In making this correction the total ground water area is taken at 6700 acres and the average porosity at 12%, which gives 800 acre feet of water per foot of averagerise or fall of water table. The amount of seepage inflow for the remainder of the season after the date of high ground water is; for 1917,-1920 acre feet and for 1919,-1563 acre feet, which reduced to feet depth of ground water over the entire area gives for 1917,-2.4 ft. and 1919,-1.9 ft., and the rates of fall for the two periods are as follows:

| DATE | DAYS | MEASURED FALL FEET | INFLOW CORRECTION-FEET | TOTAL FALL FEET | FALL PER DAY FEET |
|---|---|---|---|---|---|
| 1917-Apr.30-Dec.15 | 229 | 23.0 | 2.4 | 25.4 | .111 |
| 1919-May 20-Dec.10 | 204 | 21.8 | 1.9 | 23.7 | .116 |
| | | | | Mean | .113 |

Applying this rate of fall the 1916 total fall would have been 275 days at .113 ft., or about 30 feet, which minus the actual fall 20.6 ft., indicates about 7,500 acre feet seepage flow after March 18. Inflow of 7,500 acre feet after March 18 is not improbable, although it does look rather high.

Within the range here considered, the rate of average fall of the water table should be fairly constant. From average high water of 1916 elev. 313.0 to the average high water of 1920 elev. 289.3, the average net fall for the entire valley is 23.7 ft., which over 6,700 acres at 12% porosity represents a net loss of 19,000 acre feet for 4 years, or 4,800 acre feet per year. The average annual seepage inflow from the Coyote Creek for the same 4 years was 12,900 acre feet. The necessary annual inflow to bring the water table back to the same high each year is; 12,900 plus 4,800, or 17,700 acre feet, or say 18,000 acre feet. Considering the many factors involved this is at best only an estimate.

While 18,000 acre feet annual seepage loss from the Coyote River is necessary to prevent the Coyote Valley ground water from falling year to year, not all of this loss is contributed to the Coyote Valley. From a rough inspection of the well measurements in the Morgan Hill area, it is estimated that about 30% of the annual loss percolates away from the Coyote Valley south to the Morgan Hill Area. On the other hand, except perhaps in dry years, there is a substantial contribution to the Coyote Creek flow between Madrone and Coyote from the local drainage area to the East. In normal years the local runoff so contributed would largely offset the seepage loss away from the area to the South. In the absence of data from which to make a reasonable estimate of such local runoff none will here be made. This study is concerned chiefly with the problem of the seepage losses from the Coyote Creek, Madrone to Coyote, and the question as to seepage South is of no particular importance to the main problem.

# WELL MEASUREMENTS
## COYOTE TO MADRONE
Santa Clara County, California
Data from U.S.G.S. W.S. Paper #519, p. 152 et seq.
M.J. Bartell, Hydraulic Engineer

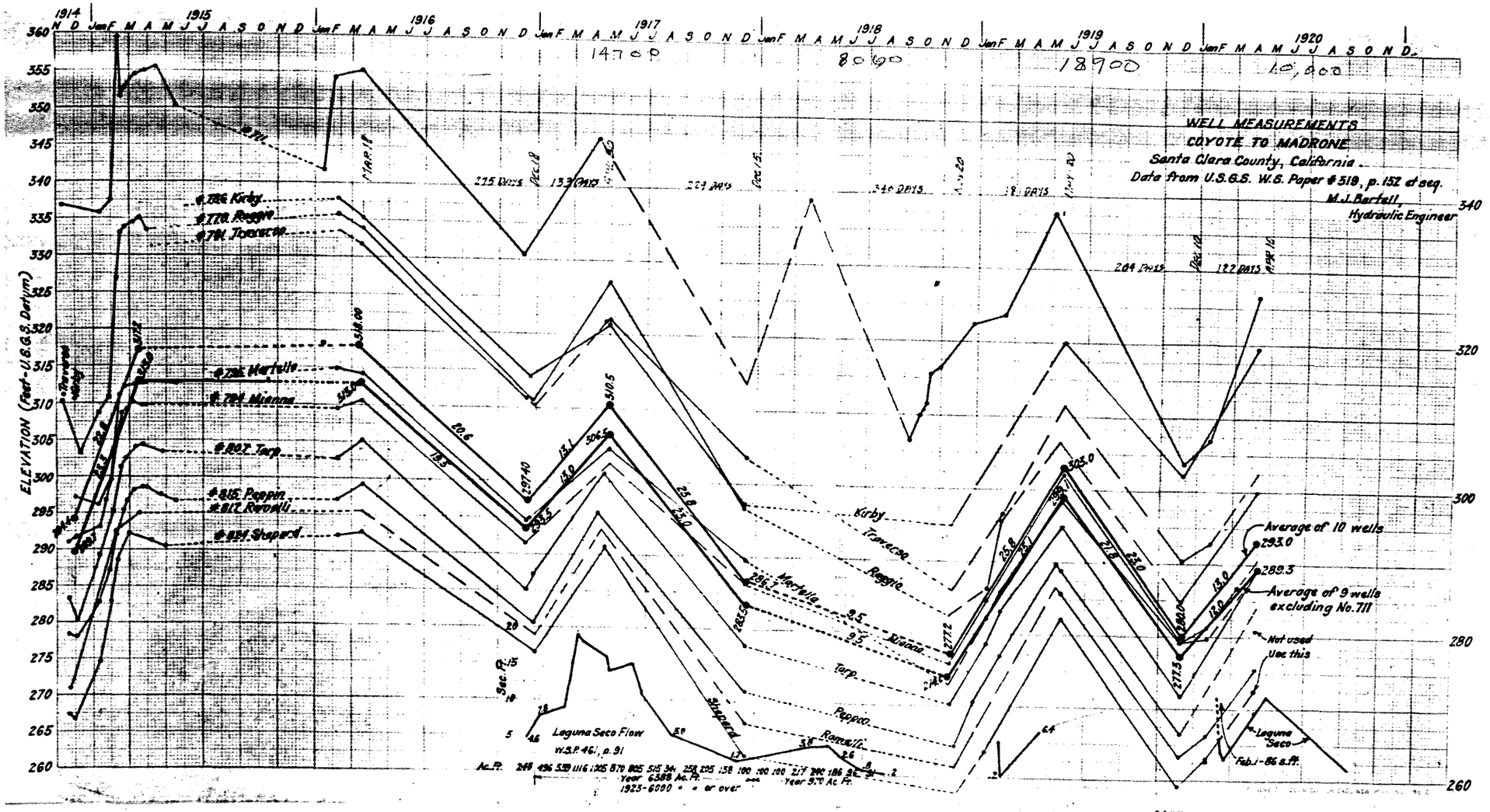


DIAGRAM No. II is an extension of a similar diagram in U.S.G.S. Water Supply Paper No. 519, page 77.

The Diagram is constructed as follows: The vertical scale is the number of days in each flow season that the flow of the Coyote Creek at Madrone is 5 seconds or over, and horizontal scale is the seepage loss in acre feet from Madrone to Coyote. The seasonal points, while showing a reasonably general trend, are in some cases quite divergent. To facilitate the drawing of the curve, the date was arranged in a series of successive 3 year means, as shown in column 4, table IV. The curve as shown is in effect a 20 year mean, and shows for any given seepage loss in acre feet, Madrone to Coyote, the corresponding number of days the flow at Madrone was 5 cubic feet per second or over.

Hereinabove it has been estimated that the average annual seepage required to bring the Coyote Valley ground water to the same high each year is about 18,000 acre feet. From Diagram II it would take about 205 days, or nearly 7 months of the normal flow of the Coyote Creek to give this amount of seepage. As to whether this time can be reduced by means of regulating the flow will be discussed later in this study.

TABLE IV

FLOW OF COYOTE CREEK, SANTA CLARA CO. CALIFORNIA-U.S.G.S.-ACRE FEET

| Season Oct. to Sept. | No. days flow is 5s. ft. or over at Madrone | Madrone | Coyote | Edenvale | Loss Madrone to Coyote | | Loss Madrone to Edenvale | | Loss Coyote as % of Edenvale |
|---|---|---|---|---|---|---|---|---|---|
| | | Col.1 | Col.2 | Col.3 | Col.4 | % | Col.5 | | Col.6 |
| 1919 | 166 | 42,167 | 28,280 | 26,273 | 13,887 | 37.6 | 15,894 | | 87.4 |
| 20 | 147 | 24,200 | 11,880 | 9.997 | 12,320 | 58.7 | 14,203 | | 86.7 |
| 21 | 185 | 39,067 | 20,367 | 17,390 | 18,700 | 55.5 | 21,677 | | 86.3 |
| 22 | 177 | 46,633 | 30,933 | 28,090 | 15,700 | 39.7 | 18,543 | | 84.7 |
| 23 | 202 | 58,867 | 42,133 | 39,967 | 16,734 | 33.6 | 19,800 | | 84.5 |
| 24 | 137 | 40,226 | 32,308 | 30,800 | 7,918 | 23.4 | 9,426 | | 84.0 |
| 25 | 127 | 21,593 | a14,458 | 13,307 | a 7,135 | 38.4 | 8,286 | | a86.1 |
| 26 | 113 | 18,126 | a10,284 | 9,007 | a 7,842 | 50.3 | 9,119 | | a86.0 |
| 27 | 184 | 35,610 | a22,193 | 20,007 | a13,417 | 43.8 | 15,603 | | a86.0 |
| 28 | 182 | 38,710 | a24,627 | 22,333 | a14,083 | 42.3 | 16,377 | | a86.0 |
| 29 | 178 | 27,693 | a16,820 | 15,050 | a10,873 | 45.7 | 12,643 | | a86.0 |
| 30 | 144 | 16,617 | a 8,397 | 7,060 | a 8,220 | 57.5 | 9,557 | | a86.0 |
| 31 | 111 | 9,673 | a 4,156 | 3,260 | a 5,517 | 66.3 | 6,413 | | a86.0 |
| 32 | 117 | 30,523 | a23,030 | 21,810 | a 7,493 | 28.5 | 8,713 | | a86.0 |
| 33 | 113 | 26,527 | a20,500 | 19,520 | a 6,027 | 26.4 | 7,007 | | a86.0 |
| 34 | 135 | 29,537 | a21,690 | 20,413 | a 7,847 | 30.9 | 9,124 | | a86.0 |
| 35 | 134 | 16,943 | a 7,706 | 6,207 | a 9,237 | 63.4 | 10,736 | | a86.0 |

"a" Estimated as shown in Table I

The figures given above in each case are 3-year means. For example: 1919 is the mean of 1917-1918-1919, and 1920 is the mean of 1918-1919-1920, etc.

M. J. BARTELL
Hydraulic Engineer
March, 1937

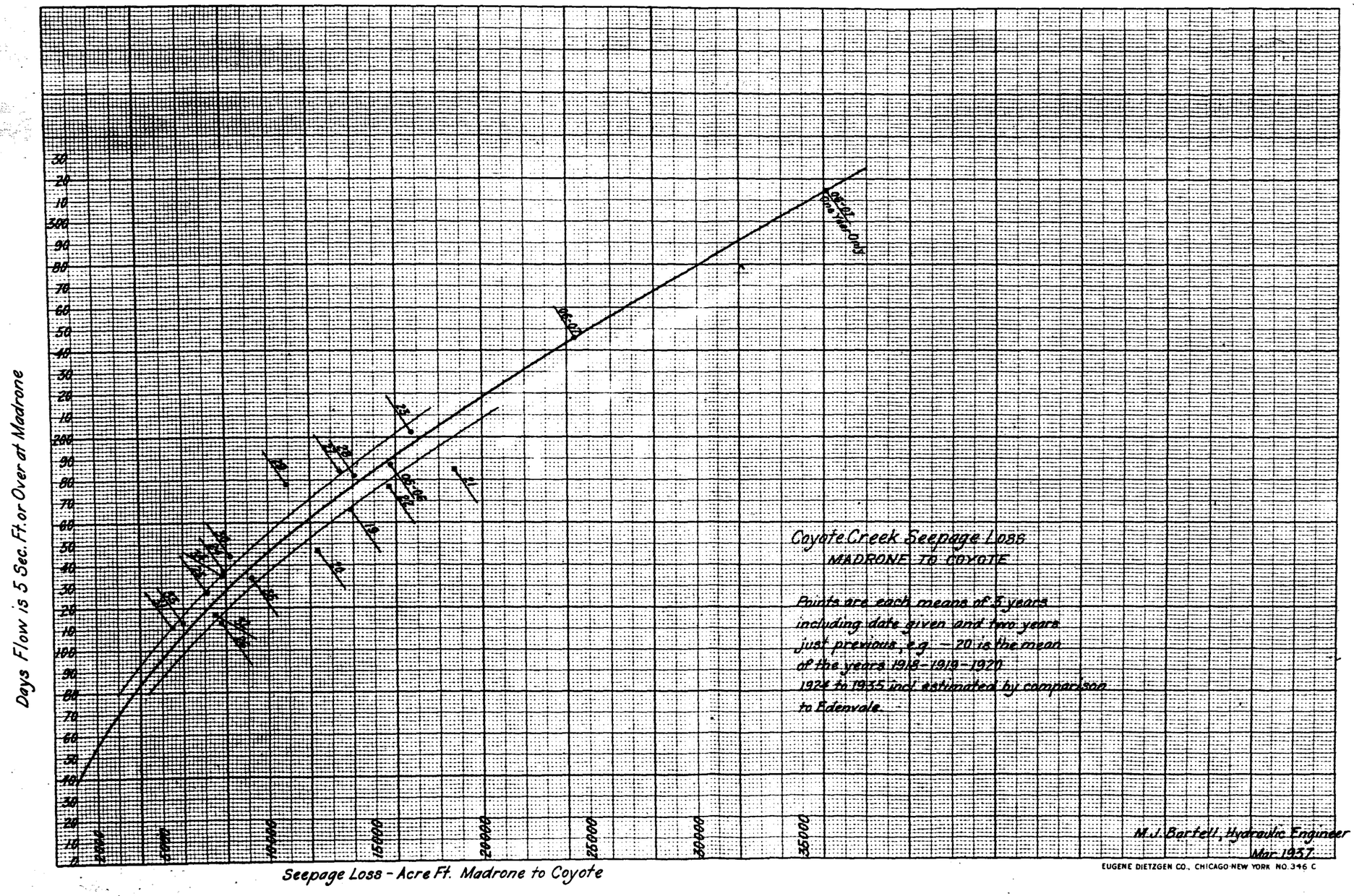

Days Flow is 5 Sec. Ft. or Over at Madrone
Seepage Loss - Acre Ft. Madrone to Coyote
Coyote Creek Seepage Loss
MADRONE TO COYOTE
Points are each means of 5 years including date given and two years just previous, e.g. — 20 is the mean of the years 1918-1919-1920
1924 to 1935 incl estimated by comparison to Edenvale
M.J. Bartell, Hydraulic Engineer
Mar. 1937.
EUGENE DIETZGEN CO., CHICAGO NEW YORK NO. 346 C

Table III following shows in detail the rates of seepage loss from Madrone to Coyote, together with corresponding rates of flow at Madrone. The maximum sustained rate of loss is for the 15 day period, January 17-31, 1921. For this period of flow from 60 to 4600 second feet mean daily or an average flow at Madrone of 1108 second feet gave an average loss of 450 second feet. The data in Table III was compiled to show maximum and short time, or detailed rates of percolation. Sustained rates of flow for longer periods of time are shown in Table V. To properly interpret rates of percolation it is necessary to know the effect, as shown by well measurements, upon the adjacent ground water. Except in fragmentary form, (See Diagram No. 1), such data is lacking.

TABLE III

SEEPAGE LOSS FROM COYOTE CREEK,
SANTA CLARA COUNTY, CALIFORNIA
MADRONE TO COYOTE
SECOND FEET PER DAY

| DATE | NO. DAYS | AVERAGE FLOW AT MADRONE | AVERAGE SEEPAGE LOSS MADRONE TO COYOTE |
|---|---|---|---|
| | | 1916 | |
| Dec. 23-31 | 9 | 364 | 169 |
| | | 1917 | |
| Jan. 1-6 | 6 | 430 | 76 |
| Jan. 6-12 | 6 | 56 | 41 |
| Jan.13-15 | 3 | 65 | 59 |
| Jan.16-31 | 16 | 23 | 20 |
| Feb. 1-19 | 19 | 16.9 | 0 |
| Feb.20-28 | 9 | 2371 | 147 |
| Mar. 1-5 | 5 | 208 | 18 |
| Mar. 6-10 | 5 | 161 | 55 |
| Mar.11-15 | 5 | 118 | 29 |
| Mar.16-21 | 5 | 85 | 26 |
| Mar.21-25 | 5 | 66 | 26 |
| Mar.26-31 | 6 | 60 | 36 |
| Apr. 1-5 | 5 | 78 | 63 |
| Apr. 6-10 | 5 | 38 | 30 |
| | | 1919 | |
| Mar. 1-5 | 5 | 214 | 75 |
| Mar. 6-10 | 5 | 172 | 83 |
| Mar.11-20 | 10 | 496 | 162 |
| Mar.21-25 | 5 | 126 | 102 |
| Mar.26-31 | 6 | 71 | 67 |
| | | 1920 | |
| Mar. 1-5 | 5 | 127 | 82 |
| Mar. 6-10 | 5 | 28 | 28 |
| Mar.11-15 | 5 | 23 | 23 |
| Mar.16-20 | 5 | 34 | 34 |
| Mar.21-25 | 5 | 417 | 179 |
| Mar.26-31 | 6 | 107 | 79 |
| Dec. 9-15 | 7 | 87 | 51 |
| Dec.16-20 | 5 | 88 | 44 |
| Dec.21-25 | 5 | 440 | 205 |
| Dec.26-31 | 6 | 61 | 20 |
| | | 1921 | |
| Jan. 1-16 | 16 | 12.8 | 12.8 |
| Jan.17-20 | 4 | 1978 | 595 |
| Jan.21-25 | 5 | 426 | 178 |
| Jan.17-25 | 9 | 1116 | 363 |
| Jan.25-31 | 6 | 1096 | 580 |
| Jan.17-31 | 15 | 1108 | 450 |
| Feb. 1-5 | 5 | 262 | 54 |
| Feb. 6-10 | 5 | 102 | 24 |
| Feb.11-15 | 5 | 71 | 36 |
| Feb.16-20 | 5 | 97 | 40 |
| Feb.21-25 | 5 | 82 | 36 |
| Feb.26-28 | 3 | 66 | 33 |

**TABLE V**

SEEPAGE LOSSES FROM COYOTE CREEK
SANTA CLARA COUNTY, CALIFORNIA, MADRONE TO COYOTE

Second Feet Per Day

| Year | Month | No. Days Accumulative | Flow at Madrone | | | Loss, Madrone to Coyote | | |
|---|---|---|---|---|---|---|---|---|
| | | | Month | Accumulative sum | Per Day | Month | Accumulative Sum | Per Day |
| 1916 | Dec. | 9 | 3,402 | 3,402 | 364 | 1,646 | 1,646 | 169 |
| 1917 | Jan. | 40 | 3,472 | 6,874 | 172 | 1,197 | 2,843 | 71 |
| | Feb. | | a21,644 | | | a 1,632 | | |
| | Mar. | 71 | 3,534 | 10,408 | 147 | 992 | 3,835 | 54 |
| | Apr. | 101 | 1,230 | 11,638 | 115 | 1,050 | 4,885 | 48 |
| | May | 132 | 543 | 12,181 | 92 | 543 | 5,428 | 41 |
| 1918 | Feb. | 7 | 264 | 264 | 38 | 264 | 264 | 38 |
| | Mar. | 38 | 5,208 | 5,472 | 144 | 3,131 | 3,395 | 89 |
| | Apr. | 68 | 310 | 5,782 | 85 | 310 | 3,441 | 51 |
| 1919 | Feb. | | a12,675 | | | a 3,322 | | |
| | Mar. | 31 | 7,936 | 7,936 | 256 | 3,317 | 3,317 | 107 |
| | Apr. | 61 | 912 | 8,848 | 145 | 910 | 4,247 | 69 |
| 1920 | Mar. | 31 | 3,782 | 3,782 | 122 | 2,193 | 2,193 | 71 |
| | Apr. | 61 | 1,860 | 5,642 | 92 | 1,440 | 3,633 | 60 |
| 1920 | Dec. | 23 | 3,628 | 3,628 | 158 | 1,737 | 1,737 | 76 |
| 1921 | Jan. | 54 | 16,833 | 20,461 | 379 | 6,957 | 8,694 | 161 |
| | Feb. | 82 | 3,276 | 23,737 | 289 | 1,103 | 9,797 | 119 |
| | Mar. | 113 | 3,720 | 27,457 | 243 | 2,784 | 12,581 | 111 |
| | Apr. | 143 | 558 | 28,015 | 196 | 520 | 13,101 | 92 |

a With the exception of these two months, the entire record is in accord. See curve showing "Rates of Seepage Loss" based on the above data.

M. J. BARTELL
Hydraulic Engineer

April, 1937.

DIAGRAM No. III, showing rates of seepage loss, Coyote to Madrone, for corresponding rates of flow at Madrone, is drawn from data shown in Tables III and V. For convenience in drawing the curve the rates have been calculated accumulatively month by month, from the beginning of the season to the end of the period of flow at Coyote. This was done to eliminate the effects of channel storage and more particularly to test the consistency of the record. The entire 5 year record is in very close accord as the diagram shows, except for two months, February 1917 and February 1919. These are months of high flow and the discrepancy may be due, to some extent, to the inflow from the adjacent foothill drainage, and also in part from inaccuracy of the measurements. The data for 1922 and 1923, like February 1917 and February 1919, as to loss, Madrone to Coyote, is entirely at variance with the data for the five year period 1917 - 1921, and it was therefore not used in making the curves. This leaves the data used in the construction of Diagram III open to the criticism of being "hand picked", which, in fact, it is; but at least it has the virtue of being consistent, in that the losses, Madrone to Coyote, show a quite definite relation to the flow passing Madrone. There are attached tables showing the daily flow at Madrone, Coyote, and the loss, Madrone to Coyote, for the period of record 1917 - 1923. Reference to these tables will show many inconsistencies or discrepancies in the records for 1922 and 1923, most of which are noted and referenced. Whatever the facts be, as to the rates of percolation, the discrepancies emphasize the necessity for comprehensive streamflow and well records.

The curves on Diagram III are made up from and represent the highest percolation rates of record, and these alone give some encouragement as to the feasibility and practicability of regulation as proposed by the Santa Clara Conservation District. Should it develop that these are lesser percolation rates, as indicated by the flow, recorded for February 1917, February 1919 and the seasons 1922, 1923, then certainly no flow would be available for the by-pass canal, which in fact is probably the case, whether the latter records be right or wrong as will be shown in the discussion later.

Diagram III shows two distinctive rates of seepage loss; curve A for seasonal flow at Madrone up to about 15,000 acre feet, and curve B for seasonal flow from about 15,000 to 60,000 acre feet. As to whether curve B applies to seasons of flow higher than 60,000 acre feet, only future observations can tell. From curve A the seepage loss, Madrone to Coyote, is 1/2 of the flow at Madrone plus 15, and from curve B is 4/10 of the flow at Madrone plus 10; all in terms of second feet per day.

Flow of the Coyote River at Madrone - Second Feet per Day

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400

Loss - Madrone to Coyote - Second Feet per Day

400 300 200 100 75 50 25

Diagram No. 3

Curve B

Jan 15 days 1-31-1921

Dec. 1916

Jan 1921

Mar 1921

Feb 1921

Mar 1919

Nov 1919

Dec 1922A

Apr 1921

Dec 1919

Mar 1920

Apr 1920

Apr 1918

Jan 1917

Mar 1917

Apr 1917

May 1917

Curve A

Curve Showing Rates of Seepage Loss
Coyote to Madrone
Coyote Creek, Santa Clara Co., Cal.

Note: These are sustained rates accumulative month by month for each season except as noted in Table No. V attached.

Rates of percolation in Second-Feet Days
x = Flow at Madrone
y = Percolation Loss Madrone to Coyote
Curve A - Maximum rate for relatively low flow of from 30 to 60 days
$y = 5/10x + 15$ $x = y$ at 30
Curve B - Sustained rate for normal season
$y = 4/10x + 10$ $x = y$ a 16.7

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DIAGRAM IV - Constructed from data in Table IV, shows as curves the total seasonal flow at Madrone and the corresponding seasonal seepage loss, Madrone to Coyote. This diagram, like diagram III, shows two distinctive curves; one for low flow seasons, up to about 15,000 acre feet of flow at Madrone, and one for normal and high flow seasons up to 60,000 acre feet.

Diagram IV confirms Diagram III in many respects. First,- all of the low flow years, 1918 - 1920 - 1924 - 1925 - 1929 - 1931 - 1933 and 1934, show the higher rate of percolation comparable to curve A. Second,- all of the normal or high flow years show distinctly lower rates than those for the low flow years; thus tending to confirm curve B. Third,- most of the high flow years are in accord, the most conspicuous exceptions being 1917 - 1922 - 1923 and 1932. These four seasons of flow of from 50,000 to 70,000 acre feet gave only from 11,000 to 15,000 acre feet percolation. These are years of considerably above average flow and in each case they show below average percolation.

Diagram No. 4.

Flow of Coyote Creek at Madrone - Acre Feet

Loss - Madrone to Coyote - Acre Feet

0 1 2 3 4 5 10 15 20 25 30 35 40 45 50 55

35 30 25 20 15 10 5 4 3 2 1 0

See Curve B - Rates of Loss

See Curve A - Rates of Loss

1904-1905 1935 1928 1927 1926 1922-23 1921 1936 1917 1930 1919 a 1920 1918 1934 1925 1929 1933 1931 1924 1903-1904

a: See Table IV

Curve Showing Seasonal Seepage Loss
Coyote to Madrone
Coyote Creek, Santa Clara Co., Cal.

Data taken from Table I except that 1917 and 1919 are corrected as shown in Table No. V.

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Table VI - gives the percolation rates in terms of flow at Madrone for curve A and Curve B, Diagram III.

TABLE VI.

COYOTE CREEK, SANTA CLARA COUNTY, CALIFORNIA

TABLE SHOWING RATES OF SEEPAGE LOSS, MADRONE TO COYOTE, AND CORRESPONDING RATES OF FLOW AT MADRONE AND COYOTE - CALCULATED FROM DIAGRAM III, CURVE A AND CURVE B.

FLOW IN SECOND FEET PER DAY

| CURVE A | | | CURVE B | | |
|---|---|---|---|---|---|
| FLOW AT MADRONE | LOSS | FLOW PAST COYOTE | FLOW AT MADRONE | LOSS | FLOW PAST COYOTE |
| | | | 16.7 | 16.7 | 0 |
| 30 | 30 | 0 | 30 | 22 | 8 |
| 40 | 35 | 5 | 40 | 26 | 14 |
| 50 | 40 | 10 | 50 | 30 | 20 |
| 60 | 45 | 15 | 60 | 34 | 26 |
| 70 | 50 | 20 | 70 | 38 | 32 |
| 80 | 55 | 25 | 80 | 42 | 38 |
| 90 | 60 | 30 | 90 | 46 | 44 |
| 100 | 65 | 35 | 100 | 50 | 50 |
| 120 | 75 | 45 | 120 | 58 | 62 |
| 140 | 85 | 55 | 140 | 66 | 74 |
| 160 | 95 | 65 | 160 | 74 | 86 |
| 180 | 105 | 75 | 180 | 82 | 98 |
| 200 | 115 | 85 | 200 | 90 | 110 |
| | | | 250 | 110 | 140 |
| | | | 300 | 130 | 170 |
| | | | 350 | 150 | 200 |
| | | | 400 | 170 | 230 |
| | | | 450 | 190 | 260 |
| | | | 500 | 210 | 290 |
| | | | 600 | 250 | 350 |
| | | | 700 | 290 | 410 |
| | | | 800 | 330 | 470 |
| | | | 900 | 370 | 530 |
| | | | 1000 | 410 | 590 |
| | | | 1100 | 450 | 650 |

Curve A applies to dry seasons or when the seasonal flow at Madrone is 15,000 Acre Feet or less and rates of flow up to about 3000 second feet.

Durve B applies to seasons at normal or high flow and rates of flow of 5000 second feet and perhaps over.

Tables VII and VIII have been calculated as follows: Column I shows the number of days the flow at Madrone was 5 second feet per day or over. Column II gives the average daily flow, in acre feet, for the number of days shown in column I. Column III is the calculated required average flow at Madrone, using curves A and B, Diagram III to give the average daily loss shown in Column VI; all for the number of days shown in Column I. Column IV is the measured average daily percolation loss, Madrone to Coyote, derived from the actual average daily flow at Madrone shown in column II. Column V on the basis assumed shows the average daily amount of water that could be diverted through the by-pass canal without reducing the measured percolation loss. It is column III minus column II. Column VI is the total for column V or column V times column I.

The object of calculating tables VII and VIII was for the purpose of determining, so far as possible, if and when water coule be diverted through the by-pass canal without reducing the amount of percolation loss that would have occurred under natural conditions.

As above stated the amounts shown in column V are the average flow in each season for the length of time shown in column I, assuming the flow records to be correct and taking the very much higher rates of percolation shown on Diagram III, that could have been by-passed around the Coyote Valley without diminishing the amount of natural percolation. This of course implies 100% regulation of all the flow which, with only 30,000 acre feet of storage, is not possible in years like 1917 - 1919 - 1922 - 1923 etc., so that the amount of water available for the by-pass canal, for ordinary high years, is something less than that shown in column V, even if the records are taken at their face value. Most conspicuous of these inconsistent records is that for 1932, which, following four seasons of very deficient percolation, shows with a flow of 69,800 acre feet at Madrone a percolation loss of only about 11,500 acre feet, whereas, compared to 1921, about 30,000 acre feet loss could have been expected.

Of the twenty season record, 16 of these seasons, with minor exceptions, are seasonably in accord, so that by applying the percolation rates shown on Diagram III to the seasons of record gives at least a preliminary idea as to the effects of regulation.

## TABLE VII

TABLE SHOWING ACTUAL AVERAGE FLOW AT MADRONE AND ACTUAL AVERAGE SEEPAGE LOSS MADRONE TO COYOTE, TOGETHER WITH ESTIMATED MEAN REGULATED FLOW NECESSARY TO GIVE THE SAME LOSS (COL. III) AND THE AMOUNT AVAILABLE FOR STORAGE AND DIVERSION CALCULATED FROM TABLE IV

| SEASON OCT. TO SEPT | FLOW AT MADRONE PER DAY: NO. DAYS 5sf OR OVER | FLOW AT MADRONE PER DAY: ACTUAL AVERAGE | FLOW AT MADRONE PER DAY: TO GIVE-LOSS IN COL. No. IV FROM DIA. 3(a) | LOSS MADRONE TO COYOTE PER DAY | AVAILABLE FOR BY PASS CANAL WITH FULL REGULATION: PER DAY | AVAILABLE FOR BY PASS CANAL WITH FULL REGULATION: PER SEA. |
|---|---|---|---|---|---|---|
| | ACRE FEET PER DAY | | | | | |
| | COL. (I) | COL. (II) | (COL. (III) | COL. (IV) | COL. (V) | COL. (VI) |
| 1917 | 195 | 348 | 138 | 75 | 210 | (b)40000 |
| 1918 | 80 | 153 | 142 | 101 | 11 | 900 |
| 1919 | 222 | 209 | 163 | 85 | 46 | 10200 |
| 1920 | 138 | 101 | 84 | 72 | 16 | 2200 |
| 1921 | 194 | 293 | 297 | 139 | 0 | 0 |
| 1922 | 198 | 349 | 50 | 40 | 299 | (b)59200 |
| 1923 | 218 | 233 | 100 | 60 | 133 | (b)29000 |
| 1924 | | | | | 0 | 0 |
| 1925 | 166 | 78 | - | 45 | 0 | 0 |
| 1926 | 172 | 234 | 171 | 88 | 63 | 10800 |
| 1927 | 215 | 248 | 153 | 81 | 95 | 20400 |
| 1928 | 159 | 142 | 100 | 60 | 42 | 8700 |
| 1929 | 160 | 45 | - | 35 | 0 | 0 |
| 1930 | 114 | 176 | 148 | 79 | 28 | 3200 |
| 1931 | 59 | 28 | - | 24 | 0 | 0 |
| 1932 | 178 | 392 | 113 | 65 | 279 | (b)49700 |
| 1933 | 101 | 80 | - | 51 | 0 | 0 |
| 1934 | 127 | 84 | - | 54 | 0 | 0 |
| 1935 | 173 | 285 | 178 | 91 | 107 | 18500 |
| 1936 | No detail for 1936 but it is quite similar to 1921 | | | | | |

(a)-Used Curve A for 1918-1920
For Curve A percolation loss is equal to the flow at Madrone for flows of 60 Acre ft. per day or less. The average flow for 1925-1929-1931-1933 and 1934 is in each case less than 60 Acre feet per day so that there could be little if any water available for diversion.

(b)-The measured loss for these years is quite probably too low and therefore the amount available for diversion shown is too high.

## TABLE VIII

TABLE SHOWING ACTUAL AVERAGE FLOW AT MADRONE AND ACTUAL AVERAGE SEEPAGE LOSS MADRONE TO COYOTE, TOGETHER WITH ESTIMATED MEAN REGULATED FLOW NECESSARY TO GIVE THE SAME LOSS (COL. III) AND THE AMOUNT AVAILABLE FOR STORAGE AND DIVERSION CALCULATED FROM TABLE IV

| | | ACRE FEET PER DAY | | | | |
|---|---|---|---|---|---|---|
| | | FLOW AT MADRONE | | | | |
| | | FLOW PER DAY | | | | AVAILABLE FOR BY-PASS CANAL |
| YEAR MONTH | NO. DAYS | ACTUAL AVERAGE | TO GIVE-LOSS IN COL. NO. IV FROM DIA. III | LOSS MADRONE TO COYOTE PER DAY | PER DAY | ACRE FEET TOTAL |
| | COL. (I) | COL. (II) | COL. (III) | COL. (IV) | COL. (V) | COL. (VI) |
| DEC. 1916 | 9 | 364 | B 397 | 169 | 0 | 00 |
| Jan. 1917 | 31 | 112 | B 73 | 39 | 39 | 2400 |
| Feb. 1917 | 28 | 773 | B 118 | 57 | 655 | (a) 36700 |
| | | | | | | 39100 |
| Mar. 1918 | 31 | 168 | A 172 | 101 | 0 | 00 |
| Feb. 1919 | 28 | 455 | B 290 | 126 | 165 | (a) 9200 |
| Mar. 1919 | 31 | 256 | B 243 | 107 | 13 | 800 |
| | | | | | | 10000 |
| Mar. 1920 | 31 | 122 | A 112 | 71 | 10 | 600 |
| Dec. 1920 | 23 | 158 | B 165 | 76 | 0 | 00 |
| | | | | | | 600 |
| Jan. 1921 | 31 | 538 | B 538 | 225 | 0 | 00 |
| Feb. 1921 | 28 | 75 | B 75 | 40 | 0 | 00 |
| Mar. 1921 | 31 | 120 | B 200 | 90 | 0 | 00 |

A Curve A Diagram III
B Curve B Diagram III

(a) Recorded percolation probably too low, and hence amounts shown as available for diversion are correspondingly too high.

The data hereinbefore presented does not justify any definite conclusions, but a few preliminary deductions may be within reason. Table VII shows that for the twenty season record there were eleven and possibly twelve seasons when little or no water would have been available for the by-pass canal, and of the remaining nine seasons the records of four are in doubt. While Column 6 shows, for eight out of the twenty seasons some water available for diversion via the by-pass canal, the figures given, even if correct as to measurement, must be materially reduced for lack of complete reservoir regulation. The curves of seepage loss derived as shown on Diagram III show that the Coyote Valley gravels take a proportionate seepage toll from every drop of water passing Madrone, and the proportion is practically the same whether the flow be 100 second feet or 5,000 second feet or over, so that waters taken from the stream above Madrone for storage in the Coyote Reservoir contain a definite calculable seepage toll due to the Coyote gravels. The seepage loss is, for normal to high flow seasons, about 4/10 of the flow at Madrone, and except for rates of flow less than 100 second feet there can be little or no gain by regulation of flow. This is demonstrated by the following comparison:

> 1921 and 1936 are seasons of almost the same total flow. In 1921 the seepage loss occurred under natural flow conditions, and in 1936 the Coyote Reservoir was in operation passing part of the stream flow down as regulated flow to the Coyote percolation works. The seepage losses for these two seasons were:

ACRE FEET

| Date | Flow at Madrone | Seepage loss Madrone to Coyote | Seepage loss as a percent of flow at Madrone |
|---|---|---|---|
| 1921 | 56,800 | 27,200 | 48% |
| 1936 | 54,300 | (a) 24,150 | 44% |

(a)-Estimated as 86% of the seepage loss Madrone to Edenvale See Table I.

With regulated flow and forced percolating during 1936, the seepage loss, Madrone to Coyote is actually relatively less than under natural conditions as shown by the season 1920-1921.

The foregoing demonstrates what the entire twenty year record shows, with the exceptions hereinabove noted, that for seasonal flow at Madrone, up to about 60,000 acre feet, practically all the water, natural flow or stored, must be passed down the natural stream bed to insure the total normal seepage to the Coyote Valley gravels. The Coyote by-pass canal is obviously built to prevent seepage to the Coyote Valley gravels, and its use for the diversion of water, either natural flow or storage, at any other time except when the Coyote gravels are full, is a direct infringement upon the riparian water rights of the Coyote valley lands

By "full" is meant such average height as best serves, both economically and practically, the prior water rights of the several parties concerned. The optimum height of the Coyote Valley ground water is the controlling factor determining the prior water rights of the valley; the maintenance of which, insofar as the total natural flow of the stream will permit, should be set as a condition precedent for any appropriative water rights on the Coyote Creek or any of its tributaries above Madrone. This will not in any manner interfere with the storage in the Coyote Reservoir. To grant an appropriation without such a condition, or its equivalent, in effect, would be placing the superior water right at the mercy of a subsequent appropriator.

This optimum height for the Coyote Valley water table, as a condition of the permit, could be preliminary set, both as to height and time, on the basis of Diagram I and such additional data as may be available, subject to revision at the discretion of the Division of Water Resources, in the light of subsequent data. This would be in line with agreements now in force between the San Francisco Water Department and the Pleasanton Township County Water District (Livermore Valley), and the San Francisco Water Department and the Alameda County Water District. These agreements are too voluminous to be herein included. In each case the San Francisco Water Department, formerly Spring Valley Water Company, accepted the full responsibility for the maintenance of the ground water levels as they would have been under natural flow conditions. In the case of the Pleasanton Water District, the San Francisco Water Department has agreed, as a penalty if the water table be lowered, to, at its own expense, deepen or dig new wells if necessary, equip the same with proper pumping plants, and pay all costs of pumping to the local land owners, etc. A few of the most pertinent clauses of this agreement are as follows:

> Wherever the Water Company is required, under the provisions of this agreement, to deepen or enlarge an existing well, or to sink a new well, it shall case such well, if it be a well coming within classes A or B, with steel casing not less than eight (8) inches in diameter; if it be a well coming within classes C and D, with steel casing not less than ten (10) inches in diameter; if it be a well coming within E or F, with steel casing not less than twelve (12) inches in diameter.
>
> Nothing herein contained shall be taken to limit the right of any of the parties of the first part to take water by means of said wells for beneficial use within said District in addition to the required amounts above specified, the Water Company, however, not to be responsible in any way either for the obtaining or the pumping of such additional amounts.

In lieu of any single well in classes C, D, E and F the Water Company shall have the option of substituting two or more wells, the combined capacity of which shall be equal to the single well for which the same are substituted, the same to be located as near such last mentioned well as practicable, and to be fully equipped, in the manner hereinbefore set out, with pumps, motors, etc., capable of delivery in efficient and economic operation the required amount of water at the required height.

In case any well in classes C, D, E and F falls short by not exceeding twenty-five (25) per cent of the required capacity of such well, but such shortage is set off by increased capacity in like amount of another well, or wells, required to be equipped by the Water Company and belonging to the party (either the Water District or Landowner) owning the first well, so that the combined capacity of the wells of such party is equal to the aggregate which it is contemplated hereunder such party shall receive, then such shortage in the first well shall be deemed to be compensated for and the Water Company shall not be required to sink or equip another well to make up such shortage.

It is the intent of this agreement that, if reasonably possible, the required amounts of water above specified shall be obtained from the said wells, or substitute wells therefor, as above provided, but in case it is found impracticable, owing to local physical conditions, so to obtain the required amounts of water, then the Water Company shall have the privilege and shall be under the obligation of supplying from some other source the required amount of water for such well which so fails wholly or in part.

The well indicated on said map and numbered 1 thereon shall be taken as the pilot well, so to speak, for said Subdivision A, the said well being so selected for the reason that, as nearly as can be determined, the Water level in said well fluctuates in accordance with the fluctuations in height of the water plane generally throughout said Subdivision A. In case said pilot well at any time becomes clogged, or for any reason cannot be used for the purpose of determining the height of the general water plane underneath said lands in Subdivision A, then, during the time that said pilot well cannot be so used, another well in the immediate vicinity shall be used as an alternate pilot well, such well to be agreed upon by the Water District and the Water Company, and in case they cannot agree, by an adjustment board appointed and acting in the manner hereinafter provided.

> Whenever the water level in said pilot well (well No. 1) shall fall below twenty-five (25) feet below the bench mark established by the Water District and the Water Company jointly at said well at the approximate surface of the ground, said bench mark having an elevation of three hundred and seventy (370) feet above sea level, (Spring Valley Water Company base), and being an iron bolt set in a concrete monument about twenty six (26) feet northeasterly from the center of the well, then the Water Company shall, during the time said water level continues below said elevation, bear the cost of the power for pumping water in all of said wells in Subdivision A, the Water Company, however, to be responsible only for the cost of power comsumed in pumping from each well during each day of twenty-four hours the required amount hereinbefore specified of water from such well, the Landowner, or the Water District, as the case may be, to bear the cost of power used in pumping any additional quantities, provided, however, that in the case of the community wells and in those cases where there is more than one well of classes E or F on the land of one Landowner, the Water Company shall be responsible for the cost of power consumed in pumping during each day of twenty-four hours the aggregate of the required amounts of water from such wells, whether such aggregate be obtained from all of said wells or less than all.

It is to be noted from the foregoing brief quotation that the subsequent appropriator has accepted certain penalties preliminary to the diversion of any water and further has accepted certain definite obligations in the event the water table is lowered below its natural state. Elsewhere in the above mentioned agreement are provisions explicitly set forth for immediately taking care of the water supply of any landowner upon complaint, such that no growing crops may be injured or lost. The Santa Clara Valley Conservation District is now operating for the second year, and so far as the Coyote Valley farmer is concerned, he knows nothing of the past operations of the District or anything of its future plans. Damage has already been done in the lower area of the Valley, and it would appear that unless the District operations are properly regulated additional damage will result.

With the many complications coincident to the storage and regulation of stream flow, and the question as to when the by-pass canal may or may not be used is a problem too involved for other than an experienced engineer, and the State Division of Water Resources is the authority upon which the Coyote Valley farmers must depend for the supervision of the operations of the Santa Clara Valley Water District. This supervision should be direct and subject to immediate revision at the discretion of the Division of Water Resources. It is to be expected that the Coyote Valley farmers will be found willing to pay to the State a proper share for such engineering supervision.

Following is a brief summary of the principal facts as to the ground water supply of the Coyote Valley, Santa Clara County, California:

(1) The ground water supply is drived almost entirely by percolation from the Coyote Creek.

(2) The ground water is an underground flowing stream, continually flowing or draining from the lower end of the valley.

(3) The normal average rise or fall of the ground water is about 20 feet per season (See Diagram I).

(4) The normal seasonal percolation required is about 18,000 acre feet.

(5) Under natural conditions it would take about 205 days of flow at Madrone to give 18,000 acre feet of percolation, (See Diagram II).

(6) With no percolation inflow the average daily fall of the water table is about 1/10 of a foot.

(7) Of the Coyote Creek water flowing from Madrone to Coyote, there are two distinctive rates of percolation loss, (See Diagrams III and IV).

Second feet per day

Curve A:
Percolation loss=one half the flow at Madrone plus 15. For seasonal flow at Madrone up to 15,000 acre feet.

Curve B;
Percolation loss=four tenths the flow at Madrone plus 10. For seasonal flow at Madrone of from about 15,000 to 60,000 Acre Feet.

(8) Up to about 60,000 Acre Feet per season natural flow of the Coyote Creek at Madrone, all the flow natural or stored, must be allowed to pass down the natural channel of the stream to insure normal percolation to the Coyote Valley gravels.

(9) For the protection of the prior water rights of the Coyote Valley farmers, no water should be diverted thru the by-pass canal, unless or until the ground water is up to normal high.

M. J. BARTELL
Hydraulic Engineer

April - 1937.

Daily discharge, in Second Feet, of Coyote Creek at Madrone and Coyote and the Loss, Madrone to Coyote — Season 19 16 19 —

| Day | Oct. 1 | Oct. 2 | Oct. 3 | Nov. 1 | Nov. 2 | Nov. 3 | Dec. 1 | Dec. 2 | Dec. 3 | Jan. 1 | Jan. 2 | Jan. 3 | Feb. 1 | Feb. 2 | Feb. 3 | Mar. 1 | Mar. 2 | Mar. 3 | Apr. 1 | Apr. 2 | Apr. 3 | May 1 | May 2 | May 3 | June 1 | June 2 | June 3 | July 1 | July 2 | July 3 | Aug. 1 | Aug. 2 | Aug. 3 | Sept. 1 | Sept. 2 | Sept. 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | 160 | 59 | 64 | 18 | 0 | 18 | 253 | 280 | 5 | 92 | 17 | 73 | | | | | | | | | | | | | |
| 2 | | | | | | | 0 | 0 | | 381 | 97 | 292 | 18 | 0 | 18 | 238 | 204 | 32 | 90 | 17 | 73 | | | | | | | | | | | | | |
| 3 | | | | | | | 0 | 0 | | 1490 | 1410 | 80 | 18 | 0 | 18 | 188 | 187 | + 1 | 80 | 17 | 63 | | | | | | | | | | | | | |
| 4 | | | | | | | 0 | 0 | | 270 | 359 | + 89 | 18 | 0 | 18 | 171 | 149 | 22 | 70 | 14 | 56 | | | | | | | | | | | | | |
| 5 | | | | | | | 0 | 0 | | 179 | 125 | 54 | 18 | 0 | 18 | 156 | 124 | 32 | 62 | 11 | 51 | | | | | | | | | | | | | |
| 6 | | | | | | | 0 | 0 | | 129 | 72 | 57 | 17 | 0 | 17 | 149 | 111 | 38 | 43 | 11 | 32 | | | | | | | | | | | | | |
| 7 | | | | | | | 0 | 0 | | 90 | 38 | 52 | 17 | 0 | 17 | 149 | 89 | 60 | 43 | 11 | 32 | | | | | | | | | | | | | |
| 8 | | | | | | | 11 | 0 | 11 | 66 | 24 | 42 | 16 | 1 | 15 | 149 | 79 | 70 | 37 | 7 | 30 | | | | | | | | | | | | | |
| 9 | | | | | | | 11 | 0 | 11 | 54 | 16 | 38 | 16 | 1 | 15 | 208 | 124 | 84 | 37 | 7 | 30 | | | | | | | | | | | | | |
| 10 | | | | | | | 95 | 0 | 10 | 48 | 7 | 41 | 17 | 2 | 15 | 149 | 124 | 25 | 32 | 6 | 26 | | | | SEASONAL | | TOTALS — | | | MADRONE | | | | |
| 11 | | | | | | | 95 | 6 | 9 | 41 | 4 | 37 | 18 | 0 | 18 | 135 | 100 | 35 | 32 | 4 | 28 | | | | | | | | | COYOTE | | | | |
| 12 | | | | | | | 9 | 0 | 9 | 36 | 3 | 33 | 18 | 1 | 17 | 109 | 81 | 34 | 32 | 3 | 29 | | | | LOSS | | MADRONE | | | TO COYOTE | | | | |
| 13 | | | | | | | 9 | 0 | 9 | 111 | 7 | 104 | 18 | 1 | 17 | 100 | 77 | 21 | 37 | 7 | 30 | | | | | | | | | | | | | |
| 14 | | | | | | | 85 | 0 | 9 | 48 | 7 | 41 | 16 | 1 | 15 | 123 | 91 | 34 | 37 | 6 | 31 | | | | | | | | | EDENVALE | | | 514 | |
| 15 | | | | | | | 9 | 0 | 9 | 36 | 3 | 33 | 15 | 0 | 15 | 111 | 89 | 22 | 43 | 6 | 37 | | | | LOSS | | MADRONE TO EDENVALE | | | | | | 16 50 | |
| 16 | | | | | | | 85 | 0 | 8 | 30 | 3 | 27 | 14 | 1 | 13 | 100 | 69 | 31 | 37 | 6 | 31 | | | | | | | | | | | | | |
| 17 | | | | | | | 8 | 0 | 8 | 28 | 3 | 25 | 14 | 1 | 13 | 90 | 69 | 21 | 40 | 7 | 33 | | | | | | | | | | | | | |
| 18 | | | | | | | 7 | 0 | 7 | 26 | 3 | 23 | 19 | 0 | 19 | 85 | 52 | 33 | 37 | 4 | 33 | | | | Note A plus (1) sign in the loss column | | | | | | | | | |
| 19 | | | | | | | 7 | 0 | 7 | 24 | 3 | 21 | 21 | 0 | 21 | 80 | 52 | 28 | 37 | 3 | 34 | | | | shows a gain | | | | | | | | | |
| 20 | | | | | | | 7 | 0 | 7 | 26 | 3 | 23 | 864 | 643 | 221 | 70 | 52 | 18 | 34 | 1 | 33 | | | | | | | | | | | | | |
| 21 | | | | | | | 7 | 0 | 7 | 26 | 3 | 23 | 5390 | 5090 | 300 | 70 | 52 | 18 | 32 | 4 | 28 | | | | | | | | | | | | | |
| 22 | | | | | | | 7 | 0 | 7 | 24 | 3 | 21 | 4310 | 4470 | +160 | 70 | 45 | 25 | 32 | 1 | 31 | | | | | | | | | | | | | |
| 23 | | | | | | | 110 | 16 | 94 | 21 | 3 | 18 | 1120 | 1160 | + 20 | 66 | 38 | 28 | 32 | 1 | 31 | | | | | | | | | | | | | |
| 24 | | | | | | | 2050 | 1320 | 730 | 21 | 3 | 18 | 3820 | 2220 | 1600 | 62 | 38 | 24 | 32 | 1 | 31 | | | | | | | | | | | | | |
| 25 | | | | | | | 475 | 216 | 259 | 21 | 2 | 19 | 3550 | 4040 | +490 | 62 | 26 | 36 | 28 | 1 | 27 | | | | | | | | | | | | | |
| 26 | | | | | | | 123 | 53 | 70 | 21 | 2 | 19 | 1150 | 1310 | +160 | 62 | 26 | 36 | 28 | 1 | 27 | | | | | | | | | | | | | |
| 27 | | | | | | | 90 | 21 | 69 | 21 | 3 | 18 | 659 | 638 | 21 | 62 | 26 | 36 | 28 | 5 | 27 | | | | | | | | | | | | | |
| 28 | | | | | | | 111 | 24 | 87 | 18 | 5 | 15 | 473 | 465 | 8 | 62 | 26 | 36 | 23 | 5 | 23 | | | | | | | | | | | | | |
| 29 | | | | | | | 135 | 59 | 76 | 18 | 3 | 15 | — | — | — | 58 | 26 | 32 | 28 | 5 | 27 | | | | | | | | | | | | | |
| 30 | | | | | | | 100 | 30 | 70 | 18 | 2 | 16 | | | | 62 | 22 | 40 | 28 | 4 | 28 | | | | | | | | | | | | | |
| 31 | | | | | | | 80 | 17 | 63 | 18 | 1 | 17 | | | | 54 | 17 | 37 | | | | | | | | | | | | | | | | | |
| | | | | | | | 364 | 1756 | 1546 | | | 1197 | | | 1632 | | | 992 | | | | | | | | | | | | | | | | | |
| | | | | | | | | | 169 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mean | 0 | 0 | 0 | 0 | 0 | 0 | 109 | 57 | 52 | 112 | 73 | 39 | 773 | 716 | 57 | 114 | 82 | 32 | 41 | 6 | 35 | 17.5 | 0 | 17.5 | 7.1 | 0 | 7.1 | 26 | 0 | 26 | 16 | 0 | 16 | 12 | 0 |
| Total Ac.Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

M. J. Bartell, Hydraulic Engineer — April, 1937

Daily discharge, in Second Feet, of Coyote Creek at Madrone and Coyote and the Loss, Madrone to Coyote Season 1917-191

| Day | Oct. 1 | Oct. 2 | Oct. 3 | Nov. 1 | Nov. 2 | Nov. 3 | Dec. 1 | Dec. 2 | Dec. 3 | Jan. 1 | Jan. 2 | Jan. 3 | Feb. 1 | Feb. 2 | Feb. 3 | Mar. 1 | Mar. 2 | Mar. 3 | Apr. 1 | Apr. 2 | Apr. 3 | May 1 | May 2 | May 3 | June 1 | June 2 | June 3 | July 1 | July 2 | July 3 | Aug. 1 | Aug. 2 | Aug. 3 | Sept. 1 | Sept. 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | 14 | 0 | | 21 | 0 | 21 | 21 | 0 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | 16 | | | 18 | 0 | 18 | 18 | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | 14 | | | 14 | 0 | 14 | 18 | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | 14 | | | 14 | 0 | 14 | 14 | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | 16 | | | 11 | 0 | 11 | 14 | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | 25 | | | 14 | 0 | 14 | 14 | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | 37 | | | 21 | 0 | 21 | 14 | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | 25 | | | 62 | 0 | 62 | 14 | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | 25 | | | 54 | 0 | 54 | 14 | | | | | | | | | | | | | | | ACRE FE |
| 10 | | | | | | | | | | | | | 25 | | | 70 | 0 | 70 | 11 | | | | | | SEASONAL | TOTALS | | | | MADRONE | | | 122 |
| 11 | | | | | | | | | | | | | 25 | | | 62 | 0 | 62 | 11 | | | | | | | | | | | | COYOTE | | | 41 |
| 12 | | | | | | | | | | | | | 25 | | | 2090 | 809 | 1281 | 11 | | | | | | LOSS | MADRONE | | | | | TO COYOTE | | | 80 |
| 13 | | | | | | | | | | | | | 25 | | | 530 | 468 | 62 | 11 | | | | | | | | | | | | EDENVALE | | | 26 |
| 14 | | | | | | | | | | | | | 25 | | | 238 | 100 | 138 | 11 | | | | | | LOSS | MADRONE | | | | | TO EDENVALE | | | 95 |
| 15 | | | | | | | | | | | | | 25 | | | 149 | 25 | 124 | 11 | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | 5 | | | 90 | 3 | 87 | 9 | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | 5 | | | 36 | 0 | 36 | 9 | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | 3.7 | | | 36 | 0 | 36 | 9 | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | 37 | | | 770 | 288 | 482 | 7 | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | 3.7 | | | 238 | 257 | +19 | 7 | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | 7 | | | 217 | 90 | 127 | 7 | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | 48 | | | 123 | 36 | 87 | 7 | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | 36 | | | 80 | 8 | 72 | 5 | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | 41 | | | 41 | 1 | 40 | 5 | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | 41 | | | 41 | 0 | 41 | 5 | | | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | 36 | | | 36 | 0 | 36 | 5 | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | 36 | | | 30 | 0 | 30 | 3.7 | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | 26 | 0 | | 26 | 0 | 26 | 3.7 | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | — | - | — | 21 | 0 | 21 | 3.7 | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | 21 | 0 | 21 | 5.0 | 0 | | | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | | | 21 | 0 | 21 | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | 3110 | | | | | | | | | | | | | | | | | | |
| Mean | 0.4 | 0 | 0.4 | 0.7 | 0 | 0.7 | 1.5 | 0 | 1.5 | 2.0 | 0 | 2 | 12. | 0 | 12 | 108 | 67 | 101 | 10. | 0 | 10 | 3.5 | 0 | 3.5 | 1.9 | 0 | 1.9 | 0.4 | 0 | 0.4 | 0.1 | 0 | 0.1 | 0.0 | 0 |
| Total Ac.Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Note: A plus (+) sign in the loss column shows a gain

M. J. Bartell, Hydraulic Engineer April, 1937

Daily discharge, in Second Feet, of Coyote Creek at Madrone and Coyote and the Loss, Madrone to Coyote Season 19 18-19 19

| Day | Oct. 1 | Oct. 2 | Oct. 3 | Nov. 1 | Nov. 2 | Nov. 3 | Dec. 1 | Dec. 2 | Dec. 3 | Jan. 1 | Jan. 2 | Jan. 3 | Feb. 1 | Feb. 2 | Feb. 3 | Mar. 1 | Mar. 2 | Mar. 3 | Apr. 1 | Apr. 2 | Apr. 3 | May 1 | May 2 | May 3 | June 1 | June 2 | June 3 | July 1 | July 2 | July 3 | Aug. 1 | Aug. 2 | Aug. 3 | Sept. 1 | Sept. 2 | Sept. 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | 915 | 2 | 9 | 217 | 172 | 25 | 54 | 1. | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | 9 | 0 | 9 | 217 | 118 | 99 | 54 | .6 | | | | | | | | | | | | | | | |
| 3 | | | | | | | 85 | | | | | | 9 | 0 | 9 | 261 | 191 | 70 | 54 | .4 | | | | | | | | | | | | | | | |
| 4 | | | | | | | 8 | | | | | | 9 | 0 | 9 | 198 | 110 | 88 | 51 | | | | | | | | | | | | | | | | |
| 5 | | | | | | | 75 | | | | | | 8 | 0 | 8 | 179 | 86 | 93 | 48 | | | | | | | | | | | | | | | | |
| 6 | | | | | | | 85 | | | | | | 7 | 0 | 7 | 179 | 61 | 118 | 42 | | | | | | | | | | | | | | | | |
| 7 | | | | | | | 9 | | | | | | 7 | 0 | 7 | 261 | 223 | 38 | 40 | | | | | | | | | | | | | | | | |
| 8 | | | | | | | 75 | | | | | | 7 | 0 | 7 | 163 | 73 | 90 | 36 | | | | | | | | | | | | | | | | |
| 9 | | | | | | | 198 | | | | | | 420 | 0 | 420 | 135 | 61 | 74 | 33 | | | | | | | | | | | | | | | | |
| 10 | | | | | | | 100 | | | | | | 3350 | 2290 | 1060 | 123 | 30 | 93 | 32 | | | | SEASONAL | | TOTALS | | | | MADRONE | | | 46400 | | |
| 11 | | | | | | | 29 | | | | | | 3460 | 4320 | +860 | 123 | 20 | 103 | 30 | | | | | | | | | | | | COYOTE | | | 27500 | | |
| 12 | | | | | | | 18 | | | | | | 675 | 572 | 103 | 111 | 14 | 97 | 29 | | | | | Loss | | | MADRONE TO COYOTE | | | | | | 18900 | | |
| 13 | | | | | | | 14 | | | | | | 455 | 223 | 232 | 386 | 155 | 231 | 29 | | | | | | | | | | | | | | | | |
| 14 | | | | | | | 12 | | | | | | 198 | 100 | 98 | 1820 | 1240 | 580 | 28 | | | | | | | | | | | | EDENVALE | | | 2480 | | |
| 15 | | | | | | | 11 | | | | | | 238 | 57 | 181 | 920 | 830 | 90 | 27 | | | | | Loss | | | MADRONE TO | | | | EDENVALE | | | 21,60 | | |
| 16 | | | | | | | 11 | | | | | | 261 | 32 | 229 | 511 | 492 | 69 | 26 | | | | | | | | | | | | | | | | |
| 17 | | | | | | | 10 | | | | | | 238 | 30 | 208 | 403 | 271 | 132 | 25 | | | | | | | | | | | | | | | | |
| 18 | | | | | | | 10 | | | | | | 238 | 32 | 206 | 285 | 186 | 99 | 24 | | | Note: Apps(+) sign in The loss column | | | | | | | | | | | | | |
| 19 | | | | | | | 9 | | | | | | 228 | 24 | 204 | 217 | 95 | 122 | 24 | | | shows again | | | | | | | | | | | | | |
| 20 | | | | | | | 9 | | | | | | 208 | 14 | 196 | 179 | 82 | 97 | 23 | | | | | | | | | | | | | | | | |
| 21 | | | | | | | 12 | | | | | | 217 | 7 | 210 | 163 | 44 | 119 | 23 | | | | | | | | | | | | | | | | |
| 22 | | | | | | | 10 | | | | | | 217 | 6 | 211 | 135 | 32 | 103 | 22 | | | | | | | | | | | | | | | | |
| 23 | | | | | | | 9 | | | | | | 238 | 30 | 208 | 123 | 20 | 103 | 22 | | | | | | | | | | | | | | | | |
| 24 | | | | | | | 9 | | | | | | 261 | 57 | 204 | 111 | 14 | 97 | 21 | | | | | | | | | | | | | | | | |
| 25 | | | | | | | 8 | | | | | | 238 | 37 | 201 | 100 | 12 | 88 | 20 | | | | | | | | | | | | | | | | |
| 26 | | | | | | | 8 | | | | | | 632 | 506 | 126 | 90 | 8 | 82 | 20 | | | | | | | | | | | | | | | | |
| 27 | | | | | | | 7 | | | | | | 550 | 594 | +44 | 80 | 7 | 73 | 19 | | | | | | | | | | | | | | | | |
| 28 | | | | | | | 8 | | | | | | 340 | 289 | 51 | 70 | 5 | 65 | 19 | | | | | | | | | | | | | | | | |
| 29 | | | | | | | 7 | | | | | | — | — | — | 66 | 4 | 62 | 19 | | | | | | | | | | | | | | | | |
| 30 | | | | | | | 7 | | | | | | | | | 62 | 2 | 60 | 19 | | | | | | | | | | | | | | | | |
| 31 | | | | | | | 7 | | | | | | | | | 58 | 1 | 57 | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | 3507 | | | 3317 | | | | | | | | | | | | | | | | | |
| Mean | | | | | | | 19.7 | | | 8.3 | | | 455 | 329 | 126 | 256 | 149 | 107 | 30.7 | 0 | 30 | 15 | | | 10 | | | 4.6 | | | 1.5 | | | 0.5 | | |
| Total Ac. Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

M. J. Bartell, Hydraulic Engineer April, 1937

Daily discharge, in Second Feet, of Coyote Creek at Madrone and Coyote and the Loss, Madrone to Coyote Season 19[19]-19[20]

| Day | Oct. 1 | Oct. 2 | Oct. 3 | Nov. 1 | Nov. 2 | Nov. 3 | Dec. 1 | Dec. 2 | Dec. 3 | Jan. 1 | Jan. 2 | Jan. 3 | Feb. 1 | Feb. 2 | Feb. 3 | Mar. 1 | Mar. 2 | Mar. 3 | Apr. 1 | Apr. 2 | Apr. 3 | May 1 | May 2 | May 3 | June 1 | June 2 | June 3 | July 1 | July 2 | July 3 | Aug. 1 | Aug. 2 | Aug. 3 | Sept. 1 | Sept. 2 | Sept. 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | 17 | 0 | | | | | | | | 163 | 0 | 163 | 38 | | | | | | | | | | | | | | | | |
| 2 | | | | | | | 10 | 0 | | | | | | | | 198 | 177 | 21 | 30 | | | | | | | | | | | | | | | | |
| 3 | | | | | | | 11 | 0 | | | | | | | | 129 | 42 | 87 | 26 | | | | | | | | | | | | | | | | |
| 4 | | | | | | | 5 | 0 | | | | | | | | 106 | 10 | 96 | 22 | | | | | | | | | | | | | | | | |
| 5 | | | | | | | 34 | 0 | | | | | | | | 41 | 0 | 41 | 21 | | | | | | | | | | | | | | | | |
| 6 | | | | | | | 35 | 0 | | | | | | | | 30 | 0 | 30 | 21 | | | | | | | | | | | | | | | | |
| 7 | | | | | | | 35 | 0 | | | | | | | | 21 | 0 | 21 | 19 | | | | | | | | | | | | | | | | |
| 8 | | | | | | | 22 | 0 | | | | | | | | 18 | 0 | 18 | 18 | | | | | | | | | | | | | | | | |
| 9 | | | | | | | 22 | 0 | | | | | | | | 18 | 0 | 18 | 41 | | | | | | | | | | | | | | | | |
| 10 | | | | | | | 22 | 0 | | | | | | | | 54 | 0 | 54 | 90 | | | | | | SEASONAL | | TOTALS | | | MADRONE | | | 14,000 | |
| 11 | | | | | | | 123 | 0 | | | | | | | | 33 | 0 | 33 | 54 | | | | | | | | | | | COYOTE | | | 4000 | |
| 12 | | | | | | | 177 | 10 | | | | | | | | 21 | 0 | 21 | 41 | | | | | | LOSS | | MADRONE | | | TO COYOTE | | | 10,000 | |
| 13 | | | | | | | 36 | 0 | | | | | | | | 19 | 0 | 19 | 30 | | | | | | | | | | | | | | | | |
| 14 | | | | | | | 18 | 0 | | | | | | | | 19 | 0 | 19 | 30 | | | | | | | | | | | EDENVALE | | | 257 | |
| 15 | | | | | | | 14 | 0 | | | | | | | | 14 | 0 | 14 | 403 | | | | | | LOSS | | MADRONE TO | | | EDENVALE | | | 11430 | |
| 16 | | | | | | | 13 | 0 | | | | | | | | 41 | 0 | 41 | 403 | | | | | | | | | | | | | | | | |
| 17 | | | | | | | 11 | 0 | | | | | | | | 54 | 0 | 54 | 123 | | | | | | | | | | | | | | | | |
| 18 | | | | | | | 11 | 0 | | | | | | | | 37 | 0 | 37 | 90 | | | | | | | | | | | | | | | | |
| 19 | | | | | | | 11 | 0 | | | | | | | | 21 | 0 | 21 | 66 | | | | | | | | | | | | | | | | |
| 20 | | | | | | | 11 | 0 | | | | | | | | 19 | 0 | 19 | 48 | | | | | | | | | | | | | | | | |
| 21 | | | | | | | 10 | 0 | | | | | | | | 511 | 0 | 511 | 41 | | | | | | | | | | | | | | | | |
| 22 | | | | | | | 10 | 0 | | | | | | | | 970 | 683 | 287 | 38 | | | | | | | | | | | | | | | | |
| 23 | | | | | | | 9 | 0 | | | | | | | | 370 | 380 | +10 | 30 | | | | | | | | | | | | | | | | |
| 24 | | | | | | | 9 | 0 | | | | | | | | 135 | 100 | 35 | 26 | | | | | | | | | | | | | | | | |
| 25 | | | | | | | 9 | 0 | | | | | | | | 100 | 30 | 70 | 24 | | | | | | | | | | | | | | | | |
| 26 | | | | | | | 85 | 0 | | | | | | | | 238 | 67 | 171 | 21 | | | | | | | | | | | | | | | | |
| 27 | | | | | | | 75 | 0 | | | | | | | | 135 | 57 | 78 | 21 | | | | | | | | | | | | | | | | |
| 28 | | | | | | | 7 | 0 | | | | | | | | 90 | 30 | 60 | 18 | | | | | | | | | | | | | | | | |
| 29 | | | | | | | 65 | 2 | | | | | | | | 70 | 10 | 60 | 14 | | | | | | | | | | | | | | | | |
| 30 | | | | | | | 7 | 0 | | | | | | | | 62 | 2 | 60 | 18 | | | | | | | | | | | | | | | | |
| 31 | | | | | | | 65 | 0 | | | | | | | | 44 | 0 | 44 | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | 2193 | | | | | | | | | | | | | | | | | | | |
| Mean | 0.4 | 0 | 0.4 | 1 | 0 | 1 | 18 | 0.3 | 18 | 5 | 0 | 5 | 4 | 0 | 4 | 122 | 31 | 71 | 62 | 14 | 48 | 11.8 | | | 4.3 | | | 0.8 | | | 0.2 | | | 0 | 0 | |
| Total Ac.Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Note: A plus(+) sign in the loss column shows a gain

M. J. Bartell, Hydraulic Engineer April, 1937.

Daily discharge, in Second Feet, of Coyote Creek at Madrone and Coyote and the Loss, Madrone to Coyote Season 1920-1921

| Day | 1 Col. 1 | 2 Col. 2 | 3 Col. 3 | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Flow at Madrone | Flow at Coyote | Loss, Madrone to Coyote | | | 18 1 | 26 26 | 580 570 +10 | 62 27 35 | 47 25 44 | 75 0 | | | | |
| 2 | | | | | | 18 2 | 18 18 | 273 255 18 | 54 24 30 | 44 2.5 42 | 75 0 | | | | |
| 3 | | | | | | 18 2 | 15 15 | 168 182 +14 | 54 18 36 | 36 2.5 33 | 95 0 | | | | |
| 4 | | | | | | 12 12 | 9 9 | 152 115 37 | 50 16 34 | 31 2.5 29 | 11. 0 | | | | ACRE FEET |
| 5 | | | | | | 18 2 | 10 10 | 138 97 41 | 47 14 33 | 25 2.5 25 | 12 0 | | | | |
| 6 | | | | | | 8 2 | 7 7 | 119 105 14 | 47 12 35 | 26 2.5 24 | 14 0 | SEASONAL TOTALS: | | MADRONE | 56 800 |
| 7 | | | | | | 32 2.5 0 | 12 12 | 114 101 13 | 50 10 40 | 24 2.5 21 | 15 0 | | | COYOTE | 29 600 |
| 8 | | | | | | 7.5 0 8 | 15 15 | 108 48 60 | 45 10 35 | 22 2.5 20 | 12 0 | LOSS MADRONE TO COYOTE — | | | 27 200 |
| 9 | | | | | | 38 0 38 | 12 12 | 88 46 42 | 40 6 34 | 18 2.5 15 | 11 0 | | | | |
| 10 | | | | | | 60 0 60 | 10 10 | 77 43 34 | 35 3 32 | 18 2.5 16 | 9.5 0 | | | | |
| 11 | | | | | | 79 105 +26 | 12 12 | 74 34 40 | 30 1 29 | 18 2.5 15 | 8.5 0 | | | EDENVALE | 29 800 |
| 12 | | | | | | 215 85 130 | 12 12 | 62 30 32 | 25 0 25 | 22 2.0 20 | 7.5 0 | LOSS MADRONE TO EDENVALE | | | 32 000 |
| 13 | | | | | | 79 38 41 | 12 12 | 54 30 24 | 196 225 +29 | 22 1.5 20 | 7.5 0 | | | | |
| 14 | | | | | | 79 22 57 | 12 12 | 79 26 53 | 720 85 635 | 18 1.4 17 | 7.5 0 | LOSS COYOTE TO EDENVALE | | | 4 800 |
| 15 | | | | | | 62 6 56 | 12 12 | 84 53 31 | 490 53 437 | 18 1.2 17 | 7.5 0 | | | | |
| 16 | | | | | | 50 0 50 | 12 12 | 93 68 25 | 314 48 266 | 15 1.2 14 | 7.5 0 | | | | |
| 17 | | | | | | 40 0 40 | 500 260 240 | 103 58 45 | 160 48 112 | 15 1.2 14 | 7.5 0 | | | | |
| 18 | | | | | | 30 0 30 | 3130 2380 750 | 108 58 50 | 114 43 71 | 15 .8 14 | 8.5 0 | MAXIMUM DISCHARGE | | | |
| 19 | | | | | | 145 53 92 | 2700 1830 870 | 98 53 45 | 70 36 34 | 14 .5 13 | 7.5 0 | MADRONE JAN 30, 1921 | | 11,500 | Sec. Feet |
| 20 | | | | | | 177 170 7 | 1580 1060 520 | 84 48 36 | 58 38 20 | 12 .5 12 | 8.5 0 | COYOTE " " | | 5130 | " |
| 21 | | | | | | 62 30 32 | 1070 660 410 | 88 38 40 | 62 34 28 | 12 0 12 | 15 0 | | | | |
| 22 | | | | | | 177 0 177 | 580 355 225 | 88 48 40 | 108 29 79 | 12 0 12 | 14 0 | Note A plus sign in the loss column | | | |
| 23 | | | | | | 177 34 143 | 260 95 165 | 84 48 36 | 145 30 115 | 12 0 12 | 12 0 | shows a gain | | | |
| 24 | | | | | | 1250 720 530 | 160 105 55 | 79 43 36 | 131 26 105 | 11 0 11 | 12 0 | | | | |
| 25 | | | | | | 535 390 145 | 62 26 36 | 70 40 30 | 98 23 75 | 9.5 0 10 | 12 0 | | | | |
| 26 | | | | | | 108 135 +27 | 79 58 21 | 70 38 32 | 98 22 76 | 8.5 0 8 | 12 0 | | | | |
| 27 | | | | | | 79 53 26 | 535 78 457 | 66 30 36 | 98 20 78 | 7.5 0 8 | 12 0 | | | | |
| 28 | | | | | | 54 26 28 | 343 182 161 | 62 30 32 | 98 18 80 | 7.5 0 7 | 11 0 | | | | |
| 29 | | | | | | 41 20 21 | 196 285 +89 | | 88 16 72 | 7.5 0 8 | 12 0 | | | | |
| 30 | | | | | | 36 10 26 | 4600 1710 2890 | | 79 6 73 | 7.5 0 7 | 12 0 | | | | |
| 31 | | | | | | 47 25 44 | 820 780 40 | | 62 3 59 | | 9.5 0 | | | | |
| | | | | | | | 6957 | 1103 | 2784 | 520 | | | | | |
| Mean | 0 | 0 | | | 0.5 0 05 | 118 61 57 | 543 318 225 | 117 77 40 | 120 30 90 | 18.6 1.3 17.3 | 10.3 0 10.3 | 5 0 5 | 2 0 2 | | |
| Total Ac.Ft. | | | | | | | | | | | | | | | |

M. J. Bartell, Hydraulic Engineer April, 1937.

Daily discharge, in Second Feet, of COYOTE CREEK AT MADRONE AND COYOTE AND LOSS MADRONE TO COYOTE Season 1921-1922

| Day | Oct. 1 | Oct. 2 | Oct. 3 | Nov. 1 | Nov. 2 | Nov. 3 | Dec. 1 | Dec. 2 | Dec. 3 | Jan. 1 | Jan. 2 | Jan. 3 | Feb. 1 | Feb. 2 | Feb. 3 | Mar. 1 | Mar. 2 | Mar. 3 | Apr. 1 | Apr. 2 | Apr. 3 | May 1 | May 2 | May 3 | June 1 | June 2 | June 3 | July 1 | July 2 | July 3 | Aug. 1 | Aug. 2 | Aug. 3 | Sept. 1 | Sept. 2 | Sept. 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | FLOW AT MADRONE Col. 1 | FLOW AT COYOTE Col 2 | LOSS MADRONE TO COYOTE Col 3 | | | | 12 | 0 | | 125 | 160 | +35 | 125 | 55 | 70 | 145 | 146 | + 1 | 215 | 100 | 115 | 31 | 0 | 7 | 14 | | | | | | | | | | |
| 2 | | | | | | | 12 | 0 | | 152 | 133 | 19 | 108 | 28 | 80 | 131 | 133 | + 2 | 98 | 89 | 9 | 26 | 0 | 5 | 14 | | | | | | | | | | |
| 3 | | | | | | | 8 | 0 | | 125 | 42 | 83 | 119 | 17 | 102 | 119 | 89 | 30 | 93 | 71 | 22 | 24 | 0 | 4 | 14 | | | | | | | | | | |
| 4 | | | | | | | 6 | 0 | | 125 | 10 | 115 | 108 | 10 | 98 | 108 | 89 | 19 | 93 | 42 | 51 | 24 | 0 | 3 | 12 | | | | | | | | | | |
| 5 | | | | | | | 6 | 0 | | 88 | 2 | 86 | 131 | 10 | 121 | 119 | 89 | 20 | 93 | 42 | 51 | 24 | 0 | 2 | 12 | | | | | | | | | | |
| 6 | | | | | | | 5 | 0 | | 88 | 22 | 66 | 131 | 3 | 128 | 98 | 80 | 18 | 93 | 32 | 61 | 24 | 0 | | 12 | | | | | | | | | | |
| 7 | | | | | | | 6 | 0 | | 237 | 71 | 166 | 145 | 5 | 140 | 93 | 71 | 22 | 93 | 32 | 61 | 24 | 0 | | 12 | | | | SEASONAL TOTALS | | | AC FEET | | |
| 8 | | | | | | | 8 | 0 | | 119 | 42 | 77 | 800 | 250 | 550 | 84 | 71 | 13 | 93 | 28 | 65 | 24 | 0 | | 12 | | | | | | MADRONE | | 69100 | | |
| 9 | | | | | | | 8 | 0 | | 114 | 17 | 97 | 4850 | 4400 | 450 | 79 | 63 | 16 | 88 | 22 | 66 | 24 | 0 | | 12 | | | | | | COYOTE | | 59200 | | |
| 10 | | | | | | | 8 | 0 | | 58 | 12 | 46 | 5200 | 4950 | 250 | 79 | 55 | 24 | 79 | 17 | 62 | 24 | 0 | | 12 | | | | LOSS MADRONE TO | | COYOTE | | 9900 | | |
| 11 | | | | | | | 8 | 0 | | 54 | 6 | 48 | 3500 | 4100 | +600 | 215 | 220 | + 5 | 79 | 17 | 62 | 24 | 0 | | 11 | | | | | | | | | | |
| 12 | | | | | | | 8 | 0 | | 41 | 3 | 38 | 1000 | 1120 | +120 | 535 | 302 | 233 | 79 | 17 | 62 | 24 | 0 | | 11 | | | | | | EDENVALE | | 56900 | | |
| 13 | | | | | | | 8 | 0 | | 35 | 1 | 34 | 800 | 700 | 100 | 430 | 252 | 178 | 66 | 28 | 38 | 24 | 0 | | 11 | | | | LOSS MADRONE TO | | EDENVALE | | 12200 | | |
| 14 | | | | | | | 8 | 0 | | 33 | 0 | 33 | 376 | 350 | 26 | 108 | 205 | +97 | 62 | 32 | 30 | 22 | 0 | | 11 | | | | | | | | | | |
| 15 | | | | | | | 8 | 0 | | 28 | 0 | 28 | 215 | 250 | +35 | 108 | 175 | +67 | 62 | 37 | 25 | 21 | 0 | | 11 | | | | | | | | | | |
| 16 | | | | | | | 7 | 0 | | 20 | 0 | 20 | 215 | 190 | 25 | b 93 | b 320 | +227 | 62 | 32 | 30 | 19 | 0 | | 11 | | | | Note A plus sign in the loss | | | | | | |
| 17 | | | | | | | 7 | 0 | | 20 | 0 | 20 | 177 | 110 | 67 | 93 | 220 | +127 | 58 | 24 | 34 | 18 | 0 | | 11 | | | | column shows a gain: | | | | | | |
| 18 | | | | | | | 1.1 | 0 | | 16 | 0 | 16 | 152 | 89 | 63 | 98 | 190 | +92 | 54 | 24 | 30 | 18 | 0 | | 11 | | | | | | | | | | |
| 19 | | | | | | | 1.0 | 0 | | 16 | 0 | 16 | b 273 | 302 | +29 | 160 | 160 | 0 | 47 | 17 | 30 | 18 | 0 | | 11 | | | | | | | | | | |
| 20 | | | | | | | 22 | 0 | | 16 | 0 | 16 | 1250 | 1250 | 0 | 177 | 133 | 44 | 44 | 15 | 29 | 18 | 0 | | 85 | | | | | | | | | | |
| 21 | | | | | | | 32 | 0 | | 12 | 0 | 12 | 870 | 910 | +40 | 145 | 122 | 23 | 41 | 14 | 27 | 18 | 0 | | 85 | | | | | | | | | | |
| 22 | | | | | | | 15 | 0 | | 14 | 0 | 14 | 314 | 430 | +116 | 146 | 110 | 35 | 41 | 10 | 31 | 16 | 0 | | 85 | | | | | | | | | | |
| 23 | | | | | | | 55 | 0 | | 17 | 0 | 17 | 177 | 375 | +198 | 145 | 89 | 56 | 41 | 10 | 31 | 15 | 0 | | 85 | | | | | | | | | | |
| 24 | | | | | | | a 260 | 580 | +320 | 15 | 0 | 15 | 168 | 320 | +160 | 145 | 89 | 56 | 39 | 8 | 31 | 15 | 0 | | 85 | | | | | | | | | | |
| 25 | | | | | | | 1020 | 910 | 110 | 15 | 0 | 15 | 145 | 252 | +107 | 145 | 80 | 65 | 38 | 6 | 32 | 15 | 0 | | 85 | | | | | | | | | | |
| 26 | | | | | | | 450 | 490 | +40 | 16 | 0 | 16 | 215 | 220 | + 5 | 103 | 71 | 32 | 36 | 5 | 31 | 15 | 0 | | 65 | | | | | | | | | | |
| 27 | | | | | | | 1190 | 730 | 460 | 15 | 0 | 15 | 160 | 190 | +30 | 98 | 71 | 27 | 36 | 3 | 33 | 15 | 0 | | 55 | | | | | | | | | | |
| 28 | | | | | | | 430 | 595 | +165 | 17 | 0 | 17 | 160 | 160 | 0 | 98 | 55 | 43 | 36 | 3 | 33 | 14 | 0 | | 55 | | | | | | | | | | |
| 29 | | | | | | | 79 | 89 | + 10 | 15 | 0 | 15 | — | — | — | 98 | 55 | 43 | 36 | 2 | 34 | 14 | 0 | | 48 | | | | | | | | | | |
| 30 | | | | | | | 84 | 71 | 13 | 44 | 0 | 44 | — | — | — | 98 | 42 | 56 | 34 | 2 | 32 | 14 | 0 | | 48 | | | | | | | | | | |
| 31 | | | | | | | 88 | 42 | 46 | 119 | 42 | 77 | — | — | — | 119 | 71 | 48 | — | — | — | 14 | | | | | | | | | | | | | |
| | | | | | | | 3541 | 35.7 | 89 | | | 1316 | | | 830 | | | | | | 1298 | | | | | | | | | | | | | |
| Mean | 0.5 | | | 0.6 | | | 115 | 113 | 2 | 58 | 18 | 40 | 781 | 752 | 29 | 142 | 126 | 16 | 68 | 26 | 42 | 20 | 0 | 20 | 10 | 0 | 10 | 3.9 | 0 | 4 | 1.5 | 0 | | 0.9 | 0 | |
| Total Ac.Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

a On first day of flood Coyote flow shows greater than or equal to Madrone

b Both Coyote and Edenvale show rise on Mar 16.

M. J. Bartell, Hydraulic Engineer April, 1937

Daily discharge, in Second Feet, of COYOTE CREEK AT MADRONE AND COYOTE AND LOSS MADRONE TO COYOTE — Season 1921-1922

| Day | Oct. 1 | Oct. 2 | Oct. 3 | Nov. 1 | Nov. 2 | Nov. 3 | Dec. 1 | Dec. 2 | Dec. 3 | Jan. 1 | Jan. 2 | Jan. 3 | Feb. 1 | Feb. 2 | Feb. 3 | Mar. 1 | Mar. 2 | Mar. 3 | Apr. 1 | Apr. 2 | Apr. 3 | May 1 | May 2 | May 3 | June 1 | June 2 | June 3 | July 1 | July 2 | July 3 | Aug. 1 | Aug. 2 | Aug. 3 | Sept. 1 | Sept. 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | 37 | | 3 | 91 | 1 | 90 | 92 | 85 | 7 | 45 | 16 | 29 | 26 | 0 | 26 | 26 | 14 | | | | | | | | | | | |
| 2 | | | | | | | 34 | | 3 | 72 | 1 | 71 | 42 | 53 | +11 | 41 | 14 | 30 | 42 | 20 | 22 | 26 | 14 | | | | | | | | | | | |
| 3 | | | | | | | 34 | | 3 | 58 | 1 | 57 | 20 | 48 | +28 | 43 | 12 | 31 | 100 | 90 | 10 | 24 | 13 | | | | | | | | | | | |
| 4 | | | | | | | 34 | | 4 | 54 | 1 | 53 | (b) 83 | 42 | 41 | 42 | 10 | 32 | 60 | 40 | 20 | 24 | 12 | | | | | | | | | | | |
| 5 | | | | | | | 35 | | 4 | 45 | 1 | 44 | 87 | 37 | 40 | 41 | 8 | 33 | 250 | 100 | 150 | 23 | 12 | | | | | | | | | | | |
| 6 | | | | | | | (a) 42 | 10 | 32 | 40 | 1 | 39 | 87 | 32 | 55 | 40 | 5 | 35 | 720 | 630 | 90 | 22 | 14 | SEASONAL TOTALS | | | MADRONE | | | | | | 507 | |
| 7 | | | | | | | 40 | 30 | 10 | 35 | 1 | 34 | 79 | 24 | 55 | 38 | 6 | 32 | 330 | 320 | 10 | 22 | 16 | | | | COYOTE | | | | | | 376 | |
| 8 | | | | | | | 935 | 805 | 130 | 31 | 0 | 31 | 79 | 16 | 61 | 37 | 5 | 32 | 158 | 166 | + 8 | 20 | 15 | LOSS MADRONE TO COYOTE | | | | | | | | | 131 | |
| 9 | | | | | | | 42 | 60 | + 18 | 31 | 0 | 31 | 79 | 24 | 55 | 36 | 2 | 34 | 114 | 53 | 61 | 20 | 13 | | | | | | | | | | | |
| 10 | | | | | | | 900 | 700 | 200 | 30 | 0 | 30 | 79 | 24 | 55 | 34 | 2 | 32 | 158 | 31 | 127 | 18 | 12 | | | | EDENVALE | | | | | | 355 | |
| 11 | | | | | | | 200 | 500 | +300 | 27 | 0 | 27 | 232 | (c) 490 | +258 | 32 | 2 | 30 | 109 | 14 | 95 | 18 | 17 | LOSS MADRONE TO EDENVALE | | | | | | | | | 152 | |
| 12 | | | | | | | 1600 | 1100 | 500 | 23 | 0 | 26 | 348 | (c) 490 | +142 | 31 | 2 | 29 | 95 | 10 | 85 | 17 | 17 | | | | | | | | | | | |
| 13 | | | | | | | 1600 | 1900 | +300 | 26 | 0 | 26 | 330 | 170 | 160 | 30 | 2 | 28 | 79 | (c) 90 | + 11 | 17 | 17 | | | | | | | | | | | |
| 14 | | | | | | | 490 | 810 | +320 | 24 | 0 | 24 | 300 | 135 | 165 | 30 | 1 | 29 | 72 | 195 | +123 | 17 | 17 | Note A plus sign in the loss column | | | | | | | | | | |
| 15 | | | | | | | (a) 245 | 225 | 20 | 22 | 0 | 22 | 270 | 85 | 185 | 28 | 2 | 26 | 65 | 166 | +101 | 16 | 17 | shows a gain. | | | | | | | | | | |
| 16 | | | | | | | 137 | 85 | 52 | 22 | 0 | 22 | 191 | 67 | 129 | 28 | 1 | 27 | 58 | 53 | 5 | 16 | 18 | | | | | | | | | | | |
| 17 | | | | | | | 210 | 85 | 125 | 45 | 0 | 45 | 137 | 53 | 84 | 27 | 1 | 26 | 58 | 41 | 17 | 16 | 19 | | | | | | | | | | | |
| 18 | | | | | | | 137 | 85 | 52 | 42 | 0 | 42 | 87 | (d) 104 | + 17 | 26 | 0 | 26 | 58 | 36 | 22 | 16 | 20 | | | | | | | | | | | |
| 19 | | | | | | | 114 | 76 | 38 | 40 | 0 | 40 | 87 | 67 | 20 | 26 | 0 | 26 | 51 | 14 | 37 | 15 | 20 | | | | | | | | | | | |
| 20 | | | | | | | 87 | 51 | 36 | 40 | 0 | 40 | 87 | 53 | 34 | 26 | 0 | 26 | 45 | 14 | 31 | 15 | 15 | | | | | | | | | | | |
| 21 | | | | | | | 72 | 53 | 19 | 37 | 0 | 37 | 87 | 32 | 55 | 25 | 0 | 25 | 42 | 14 | 28 | 15 | 10 | | | | | | | | | | | |
| 22 | | | | | | | 54 | 42 | 12 | 100 | 90 | 10 | 68 | 32 | 36 | 24 | 0 | 24 | 40 | 8 | 32 | 14 | 4 | | | | | | | | | | | |
| 23 | | | | | | | 33 | 24 | 9 | 1700 | 1300 | 400 | 65 | 32 | 33 | 24 | 0 | 24 | 38 | 2 | 36 | 13 | 4 | | | | | | | | | | | |
| 24 | | | | | | | 30 | 20 | 10 | 3600 | 3000 | 600 | 65 | 32 | 33 | 24 | 0 | 24 | 37 | 18 | 35 | 13 | 3 | | | | | | | | | | | |
| 25 | | | | | | | 30 | 15 | 15 | 2700 | 2700 | 0 | 58 | 24 | 34 | 23 | 0 | 23 | 36 | 16 | 34 | 12 | 2 | | | | | | | | | | | |
| 26 | | | | | | | 27 | 10 | 17 | 320 | 362 | + 42 | 58 | 24 | 34 | 23 | 1 | 22 | 34 | 18 | 32 | 12 | 2 | | | | | | | | | | | |
| 27 | | | | | | | 30 | 8 | 22 | 348 | 195 | 153 | 59 | 20 | 39 | 22 | 2 | 20 | 31 | 18 | 30 | 12 | 2 | | | | | | | | | | | |
| 28 | | | | | | | 46 | 5 | 41 | 220 | 182 | 38 | 51 | 16 | 35 | 22 | 2 | 20 | 30 | 20 | 28 | 12 | 1 | | | | | | | | | | | |
| 29 | | | | | | | 114 | 3 | 111 | 191 | 170 | 21 | — | — | — | 21 | 1 | 20 | 29 | 18 | 27 | 12 | 1 | | | | | | | | | | | |
| 30 | | | | | | | 104 | 1 | 103 | 182 | 118 | 64 | | | | 20 | 1 | 19 | 28 | 16 | 27 | 11 | 1 | | | | | | | | | | | |
| 31 | | | | | | | 98 | 1 | 97 | 76 | 91 | + 15 | | | | 21 | 0 | 21 | | | | 11 | | | | | | | | | | | | | |
| Mean | | | | | | | 224 | 200 | 24 | 331 | 265 | 66 | 117 | 83 | 34 | 30 | 3 | 27 | 100 | 71 | 29 | 16.9 | 1.1 | 16 | 8 | 0 | 8 | 3.8 | 0 | 3.8 | 1.7 | 0 | 1.7 | 1 | 0 |
| Total Ac-Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

(a) Dec 6 to 15 incl Coyote gained 46 (b) No increase at Edenvale or Coyote (c) Edenvale also exceeds Madrone (d) Increase not shown at Edenvale.

(c) Edenvale shows no corresponding gain.

M. J. Bartell, Hydraulic Engineer April, 1937

San Francisco, California,
November 6, 1937.

Mr. Harold Conkling
Deputy in charge of Water Rights
Division of Water Resources
401 Public Works Building
Sacramento, California

RE: Application 7140-8388

Dear Sir:

I have your letter of October 13th, re granting a conditional permit in the above-mentioned application.

I take it that the matter contained in your letter is merely a very general outline of the conditions to be written into the permit. The conditions to be such, in the opinion of the Division of Water Resources, that the Coyote Valley will receive from the annual stream flow of the Coyote Creek approximately the same annual amount of percolation with approximately the same distribution of the percolation, both as to time and place, such that the underground water plane in the Coyote Valley shall be maintained at approximately the same state as would have occurred under natural stream flow conditions.

The proof of an appropriative water right rests principally upon two things: first upon proof that there is an excess after satisfying all prior rights, and, second, that such excess can be taken without interference or infringement upon such prior rights.

A portion of the flood flow of Coyote Creek is wasted into San Francisco Bay and such waste can and should be conserved, so that the first condition above mentioned is satisfied; as to the second condition, no evidence has been presented.

The Division of Water Resources is fully aware of the many demands made upon the Santa Clara Valley Conservation District both by the writer and other interested parties, for some showing or proof as to the amount of excess waters available on Coyote Creek, and some proof or showing that such excess water can be taken from the creek without injury to the prior riparian rights of the Coyote Valley.

As stated by the writer in a letter addressed to the Division of Water Resources dated October 13, 1936, the only notice to the Coyote Valley land owner as to the intentions of the Conservation District with respect to the Coyote Creek waters is that appearing in the published reports of the District.

At the meeting held in the office of the Santa Clara Valley Conservation District in San Jose March 31, 1937, the writer made demand upon the District's Chief Engineer, Mr. Fred H. Tibbetts, for a statement of the proposed operation of the

Coyote Reservoir and Diversion Canal, and he stated that the District proposed to operate as stated in its printed reports, and I therefore quote as follows:

Excerpt from Report on Waste Water Salvage Project, Santa Clara Valley Water Conservation District, by F. H. Tibbetts, Chief Engineer, October 2, 1931.

Page 42.

"Coyote Valley Water Requirements.

The riparian doctrine, firmly established in California, gives prior rights to the flow of any stream to the lands bordering the stream. There is also a general feeling, not necessarily founded on a sound legal basis, but nevertheless firmly asserted, that preferential rights to water percolating from stream beds are vested in the valley of that stream. In the decree of the Hayes-Chynoweth vs. Bay Cities Water Co. case, certain prescribed rules were laid down for apportioning water to the Coyote gravels after which water might be diverted for use elsewhere in the valley. Under the terms of this decision, the first 18,800 acre feet of the Coyote's annual runoff should be released at such a rate as would permit of complete absorption. 6.6% of the balance of the streamflow should be similarly reserved for the Coyote Valley. Under this ruling the Coyote Valley should normally receive about 20,000 ft. per annum, and experience has apparently shown that in normal seasons this is insufficient for replenishment of wells drawing directly from aquifers normally replenished by Coyote stream bed flow."

See also report COYOTE CREEK AND ITS RELATION TO THE GROUND WATER OF THE COYOTE VALLEY - M. J. Bartell, Hydraulic Engineer, April, 1937, Pages 6 and 7:

"Seasonal seepage necessary to hold water table in Coyote Valley Constant."

On the basis of seepage and well measurements, 1916 to 1920 inclusive, calculations showed that it would take about 18,000 acre annual seepage to the Coyote Valley to prevent the ground water table from falling. This is in close accord with the court decision above quoted.

Excerpt from Report entitled "1934 Well Replenishment Project, Santa Clara Valley Water Conservation District" by F. H. Tibbetts, Chief Engineer, May 8, 1934.

Page 7.

"Water Requirements, Coyote Valley.

The elimination from the works formerly proposed in the "Waste Water Salvage Report" of provisions for transferring excess surplus

Coyote River water to the northwest side of the District have reduced the economic capacity of reservoir development on the Coyote River from the 60,000 acre feet formerly proposed to 30,000 acre feet. This reduced capacity will conserve sufficient water to more than equalize the overdraft in the Coyote Basin. The normal requirement for the Coyote Basin (see "Waste Water Salvage Report", page 42) as fixed by court decree in the Hayes-Chynoweth vs. Bay Cities Water Case, is 18,800 acre feet annually. The Report of the State Division of Water Resources, Bulletin 42, page 42, estimates that with 30,000 acre feet of surface storage on the Coyote (the amount proposed in the present project) the average annual waste conserved would "vary between 22,000 acre feet and 25,800 acre feet".

The above quotations are statements based upon the Superior Court decision, Santa Clara County No. 15194, Dept. No. 3, Hayes-Chynoweth Company et al, plaintiffs, vs. the Bay Cities Water Company, a corporation, et al, defendants. By substituting the Santa Clara Valley Conservation District for the Bay Cities Water Company in the above case, we have exactly the same issues, the same waters, the same stream, the same general scheme of development of storage, and it was therefore proper that the District should, and did, consider itself bound, as shown by the above quotations, by the conditions and restrictions imposed in the above case.

In making the above-mentioned decision, the Court had as a basis of fact Coyote stream flow records 1902 to 1906 inclusive, and comprehensive set of well records. The stream flow records were taken by two stream gagers continuously on duty at each station on the Coyote Creek, as follows:

Upper Gorge, Lower Gorge, Ford Road, Julian Street, Milpitas.

Flow measurements were frequently made both day and night and the resultant records are highly accurate.

Quoting from the decision, the conditions imposed were as follows:

"Therefore, with the purpose of securing and safeguarding the plaintiffs in their vested, paramount rights in and to the waters which under natural conditions and conditions heretofore existing, may be absorbed by the gravels of the Coyote river between the upper gorge and the clay creek bed near San Jose - from whatever source these absorbed waters may come - and also for the purpose of awarding to the defendants their lawful rights in the premises, the court will modify the restraining order herein and allow the defendants to appropriate, conserve and use a portion of the waters of the Coyote river and Laguna Seca, under the following rules, directions, permissions, restrictions and conditions, to-wit:

"1. The defendants will be permitted and required to construct and maintain a substantial dam of sufficient strength and capacity to impound and conserve the waters of the Coyote river

at the upper gorge. This dam must be built and the materials therein used must be in accordance with the best engineering skill of the period.

"2. They may construct at or near and across the lower gorge, a sub-surface retaining wall to retain and regulate the percolating and surface waters passing that point under the conditions herein made or hereafter imposed.

"3. From September 1st of each year the entire quantity of water which might flow through the upper gorge, if no dam were there erected, must be delivered to the gravels below the dam, when erected, until such released waters together with the entire flowage of water of Laguna Seca shall amount to 820,000,000 cubic feet (18,825 acre feet). In addition to the amount of this water the defendants must release from the upper dam and Laguna Seca 6.6 per cent of the stream's flow thereafter. Such percentage must be released at flood times or at such times as may hereafter seem best for the interests of the plaintiffs.

"4. All these waters shall be delivered at a rate averaging 80 cubic feet per second, or at a rate which will allow an entire absorption by the intake gravels.

"5. The defendants may construct a reservoir at Laguna Seca for the purpose of so regulating the flow and insuring its entire conservation and absorption, if necessary.

"6. There must be allowed to pass through the lower gorge at all times and in any event 20,000,000 gallons of water every day in the year. It shall be the duty of the defendants to see that the gravels are kept in a condition to absorb this released 20,000,000 gallons daily (61 A/F daily, or 22,400 A/F per year) above and below the lower gorge. This daily flow should be allowed to pass the cut-off wall at the lower gorge through an opening, or openings, in the wall so as to distribute the amount in the gravels at that point as they are now naturally distributed and percolating. This daily flow must be measured by an automatic device and a daily record made thereof.

"7. In addition to this twenty million gallons to daily percolate beneath the channel of the Coyote river, the defendants shall also allow to pass the lower gorge, to be absorbed by the gravels between that gorge and the Narrows, or at a point below the Narrows if found advisable, 1,300,000,000 gallons (3989 A/F) per annum. This quantity of water may be distributed over the gravels through the natural channel, or through a conduit or by other approved means. It shall be the duty of the defendants to see that this full amount is distributed over and absorbed by such gravels as under natural conditions now existing and that the gravels shall be kept free from accumulating silt. The silt problem will largely solve itself when the flood muddy waters are impounded and allowed to settle, and clear water only, released.

"8. For the purpose of accurate measurements of the flow

of the stream and of the discharge and absorption of the waters, defendants at their own expense must install and continually maintain automatic weirs or other acceptable and approved self-recording measuring devices. For the present these devices will be installed at the following points (a) where the stream flow enters the upper gorge reservoir to be constructed; (b) where the waters are discharged into the stream and gravels below the upper gorge reservoir; (c) on Laguna Seca outlet; (d) at the Narrows or at a point lower down the stream if desirable or necessary; and (e) in a well below the lower gorge, to be agreed upon by the parties or designated by the court, for the purpose of exhibiting and recording at all times the water table and well levels of the underground waters. The water plane and well levels must be maintained, and shown at all times by a large public automatic indicator established at (e) station.

"Under proper regulations all measuring devices may be inspected by plaintiffs and their attorneys and the public generally.

"9. The records of these streams' flows including the records of the percolating waters and of the waters liberated, shall be carefully preserved and filed herein quarterly in the county clerk's office, except a monthly report must be made and filed for the months of December, January, February and March of each year. This report shall contain a statement that the decree of this court has been fully complied with, or if not complied with in any particular, the reason why it has not been done must be stated. The report and the statement must be verified by an officer or responsible agent of the defendant company.

"10. After the above designated provisions have been fully complied with the defendants may appropriate and use or dispose of the remainder of the waters of the Coyote river and Laguna Seca, designated herein the flood or storm waste waters of these streams, provided always that such waters are not to be transported or used outside of said Santa Clara county, but are to be disposed of and used exclusively by and for the benefit of the inhabitants of said Santa Clara County, in which the watershed of such waters is wholly situated.

"11. The data for the stream flow and measurements of the waters herein dealt with being gathered in four seasons only, the court, while relying upon the accuracy of the facts herein stated, does not intend to jeopardize either the rights of the plaintiffs or of the defendants, or the rights of the people of the valley, by a hard and fast rule in the division and regulation of these waters. Therefore, for the purpose of carrying its decree and plan of apportionments into effect, by giving to plaintiffs for their reasonable use all the subterranean waters which they now naturally have and enjoy and by allowing the defendants to impound, conserve and appropriate for public use such waste, or run-off waters, this court on its equity side will retain jurisdiction after judgment herein over the subject matter of the controversy in this cause and reserves the right and privilege to modify, add to, or eliminate from any of the provisions and conditions incorporated in its decree, in accordance with that purpose.

"The defendants, in their briefs, have agreed to this exercise of jurisdiction and power and control over the subject matter of this action in the future. In addition to such consent of the defendants the decisions afford ample authority to a court of equity in water cases to retain jurisdiction after judgment."

From the foregoing it will be noted that the court took into consideration practically all of the factors controlling the maintenance of the natural ground water supply of the Coyote Valley; and they are made conditions precedent to the storage or diversion of any water on Coyote Creek. The court not only set the annual total amount of percolation, but also the means by which such percolation was to be attained. As to the Coyote Valley proper, the court recognized not only the priority of its ground water supply from Coyote creek, but also its right to have the natural drainage at the Lower Gorge maintained. This right to proper drainage at the Lower Gorge is in fact the condition which determines the required percolation to the Coyote Valley. Section 6 above quoted sets this underground drainage at 20 million gallons per day, which is 22,400 acre feet per year. In order to maintain this annual drainage from the valley, there must be added the amounts withdrawn for irrigation and evaporation.

The facts before the court also show, as the entire subsequent record shows, that all water flowing past Madrone contributed by percolation some portion of its flow to the ground water along its flow channel, and that by reducing such flow by withholding water in storage, the total natural percolation would be reduced or that the amount withheld for storage contained waters that would actually have percolated to the Coyote Valley under natural flow conditions. To offset the percolation loss due to the withholding water for storage, the court required artificial stiumlation of percolation as given in Section 4 above.

Section 1 of the conditions above quoted requires the building of a dam at the Upper Gorge, which would have permitted the regulation of the entire flow of Coyote Creek. The Conservation District has built its dam on Coyote Creek above its confluence with Los Animas Creek and has built the canal by-passing the Coyote Valley. This differs from the plan of development considered by the court in setting the conditions above quoted in that it leaves a portion of Coyote Creek flow unregulated and permits diversion of water pastthe Coyote Valley. The obvious purpose of this canalis to prevent percolation in the Coyote Valley and the use of this canal without specific and explicit restrictions is a very serious threat to the Coyote Valley water supply.

The restrictions and conditions above quoted contemplated that all the water of the Coyote Creek, including the stored water, would pass to the Lower Gorge down the natural channel of the creek and even so the court said in section 7 above quoted: "It shall be the duty of the defendants to see that this full amount is distributed over and absorbed by such gravels as under natural conditions now existing and that the gravels shall be kept free

from accumulating silt." While this particular section applies to the stream channel below the Lower Gorge, it is clear from the wording of section 4 it is intended to apply to the entire stream.

The building of the by-pass canal and the uncertainty as to how and to what extent it was to be used, is the principal reason the Coyote Valley land owners have demanded of the Conservation District a statement of its intentions as to the use of the by-pass canal.

From the published reports of the Conservation District it is quite clear that the district intends to observe the conditions imposed in the Hayes-Chynoweth case, and from our discussions at the hearings held in San Jose March 31 and October 8 of this year, it is also quite clear that District has and wishes to continue to be the sole judge as to what these conditions mean and as to how they are to be observed. At the meeting of March 31, the writer suggested that the District place the operation of its Coyote Creek works under the supervision of the Division of Water Resources to the extent that the prior water rights of the Coyote Valley might be safeguarded. This suggestion the District refused to consider and they continued to operate the Coyote reservoir and by-pass canal as they pleased.

The District's operation of its Coyote works during the present season indicates that percolation to the Coyote Valley as related to the total flow is the lowest of record, and that the operation of the filtration works below the Lower Gorge, by preventing the natural drainage from the valley, has as a result raised the water table of the lower portion of the valley to such an extent that it threatens the crops of the area.

At the meeting of October 8, both of the conditions just stated were brought to the attention of the District and both were promptly denied by the District's engineer.

And now we come to a consideration of the conditions to be written into the permit.

As to the general form of the permit, the writer can suggest nothing better than the conditions imposed by court in the Hayes-Chynoweth case above quoted, but modified in the light of later data, the new conditions presented by the construction of the Coyote by-pass canal, and the daming or restriction of the natural outflow at the Lower Gorge.

As a condition precedent to the granting of the permit the Conservation District should agree in writing to abide by all the rules, directions, permissions, restrictions, and conditions of the permit. The Division of Water Resources has indicated that it is unwilling to set the height of the ground water as a condition, or to lay down rules for the operation of the District's works. There remains then only one other way that the Coyote Valley water rights can be protected, and that is to set the annual amount of percolation, together with rules and directions as to

how such percolation is to be accomplished. In the present season's operation, the total flow was 73,600 acre feet, of which 30,000 acre feet were detained in storage, leaving 43,600 acre feet to flow down the creek, and it is not reasonable to presume that under exactly the same conditions of flow 43,600 acre feet of flow would give as much percolation as 73,600 acre feet of flow. Therefore some portion or all of the stored water must be allowed to pass down the natural creek channel to insure the same amount of percolation as would have occurred under natural conditions. Some consideration should be given to the probable silting of the stream channel due to the reduced flow. The annual or seasonal amount of percolation should be set for each year in the light of the past season's experience as shown by the ground water levels.

It is particularly urged that careful consideration be given to the prior, long-since vested rights of the riparian owners directly diverting or pumping from the stream. Certainly every drop of water stored in the Coyote reservoir owes some percolation to the Coyote Valley, and as the released water passes down the creek the abutting land owners have some rights in the water flowing, and in so far as the total percolation of the Coyote Valley is concerned it makes no difference whether water is pumped from the flowing stream or from a well on its bank.

The following is suggested as one of the specific conditions of the permit:

In order to determine the effect of the operations of the Santa Clara Valley Water Conservation District on the stream-flow and ground water conditions in the so-called Coyote Valley, that is, that portion of the Santa Clara Valley between the Cochran Road south of the town of Madrone, and the Metcalf Road north of the town of Coyote, the District shall construct or install acceptable water measuring devices and employ qualified engineers whose duties shall be to obtain measurements at the following locations:

Measurements of Flow

Suitable gaging stations equipped with automatic water stage recorders shall be established and continuous records of gage height secured, together with current meter or other acceptable measurements sufficient in number for the establishment of rating tables or curves, as required, at the following locations:

1. On the Coyote River above Coyote Reservoir,
2. On the Coyote Reservoir (gage heights),
3. On the discharge channel below Coyote Dam,
4. On the Coyote River at the so-called "Upper Gorge",
5. On the by-pass canal at its head,
6. On the by-pass canal near its point of discharge into the Coyote River (near Metcalf Road),
7. On the Coyote River at Metcalf Road,
8. On the Laguna Seca outlet near its point of discharge into the Coyote River,
9. On the Coyote River at the dam controlling the Coyote spreading works,
10. On the Coyote River at the "Narrows" opposite Edenvale.

Meter measurements shall also be made at suitable intervals during each year on the minor tributaries discharging into the Coyote River between the station at the Upper Gorge and that at Metcalf Road.

Ground Water Measurements

Weekly measurements of the water table elevations shall be made in wells located within the so-called "Coyote Valley" between Metcalf Road and Cochran Road, the location and number of which are to be agreed upon by the District, in conference with representatives of the land owners in the said valley. The elevations of all reference points shall be determined by survey.

Filing Records

All records and measurements above provided for shall be calculated and suitable tabulated and shall be open to public inspection. A copy thereof shall be filed not later than the 20th day of each calendar month with the Division of Water Resources at Sacramento, California, covering the measurements for the preceding calendar month, together with a statement that all of the conditions of the permit have been fully compled with.

Accredited representatives of the Coyote Valley land owners shall have free access to the properties and works of the Santa Clara Valley Conservation District for the purpose of inspecting all water measuring apparatus or the operation of the works or measuring or gaging water at the above designated stations or elsewhere.

I would appreciate very much the opportunity to review the specific conditions of the final permit before their final adoption.

There is under preparation a set of diagrams showing water levels in the Coyote Valley. Copies will be sent to the Division of Water Resources, to the Conservation District and to Mr. H. L. Haehl as soon as they are completed.

Very truly yours,

M. J. BARTELL
Hydraulic Engineer

cc H.L.Haehl
Santa Clara Valley Water
Conservation District
T. J. Kirby
Harold Oberg
Victor Raggio

THOS. H. MEANS
CONSULTING ENGINEER
111 SUTTER STREET
SAN FRANCISCO

September 26, 1950

Board of Directors of the
Central Santa Clara Valley
Water Conservation District,
Morgan Hill, California

Gentlemen:

A study has been made of the records of flow of Coyote River to determine the effect of storage and regulation by the Santa Clara Water Conservation District. This District put into operation in 1936 a reservoir, with a capacity of about 25,000 acre feet, on one branch of Coyote River and since then has diverted a part of the water through a canal(Coyote Canal), by-passing the part of the river channel between the mouth of the canyon and Coyote Station.

The Central Conservation District includes the part of Coyote River between the gorge and Coyote Station. The records show that the percolation from this section of the river is the most important source of water in the groundwater body underlying the Central District.

Application made to the Division of Water Rights for the water impounded in the Coyote Reservoir resulted in the issuance of a permit in which a condition was imposed to the effect that prior rights to water should be respected.

The lands in the Central District which overlie the Coyote gravels is recognized as having a prior right to the water of Coyote River at least so far as that water in a state of nature entered the groundwater body. Any change in the regimen of the river which reduces the percolation from it is an invasion of the prior right to the groundwater. In explanation of this

statement, it should be said that the Coyote Valley is a groundwater basin, similar to many such basins in Southern California. The underlying water body is not great enough to adequately supply the overlying lands - a definite overdraft has developed - and any reduction in the replenishing supply is a serious menace to the overlying landowners.

The Santa Clara District established several rating or gaging stations along the stream to study the amount of percolation and other factors and it seems to have been assumed that the operations of that District have complied with the conditions of the Division of Water Rights permit and has not reduced the replenishing supply to the Coyote gravels.

A study has been made of the first seven years records(1937-38 to 1943-44) of the operations on the Coyote River by the Santa Clara District. Records since the 1943-44 season have not been studied. In addition to these records of the Santa Clara District the stream flow records at the Madrone Station(mouth of Coyote Gorge) and the Edenvale Station have been available.

The section of the Coyote River from the mouth of the gorge to Edenvale lies within both conservation districts. The boundary between the two Districts is approximately at Coyote Station and in order to determine the effect of regulation of the stream and diversion of water through the Coyote Canal it is necessary to know what the percolation under a state of nature was between the gorge and Coyote Station and in the section below Coyote Station.

An approximate determination of the relative percolation between these two reaches of Coyote River can be made from the records of the Geological Survey for the three stations on the river measured in the seven years 1916-17 to 1922-23.

There are no detailed studies of the rate of percolation within the boundaries of the two Districts prior to the building of the Coyote Reservoir except the above.

These records are not sufficiently complete to determine the percolation between the gorge and Coyote Station because in them no account is taken of considerable flow which enters the stream in this reach, particularly Fisher Creek(Laguna Seca). They do, however, give a rough approximation.

The table attached(Table I) shows the records for the seven years prior to regulation. The total percolation between the gorge and Edenvale averaged 16,900 acre feet per year or 38 per cent of the flow at the gorge. Of this, 14,500 or 86 per cent occurred above Coyote Station and replenished the groundwater in the Central District Basin.

These figures are lower than they would be if the complete stream record of all tributaries, between the stations, was available.

As compared with this approximate estimate of the percolation to the Central District gravels, a study has been made of the more complete records since the stream has been regulated and water diverted by the Coyote Canal. In the attached table(Table II) are given the results of the seven seasons 1937-38 to 1943-44. These records are incomplete and at best can be taken as an approximation only.

In two of the seasons, 1940-41 and 1942-43, the figures are misleading and have been disregarded in the statements given below. The season 1940-41, one of the very wet years, the results of measurements show a gain between the gorge and Coyote Station rather than a loss - manifestly an error. In the 1942-43 season no measuring station was maintained at Coyote but was moved below the percolating dam. The results do not represent replenishment to the Central District.

The results of the five years selected show less water lost from the channel in the Gorge-Coyote Station reach than in the seven years prior to regulation in spite of the fact that more water was flowing at the gorge. The

total percolation above Edenvale was increased but the Central District was deprived of natural replenishment.

The operations of the stream by the Santa Clara District, therefore, have not conformed to the conditions of the permit issued by the Division of Water Rights. A more complete study should be made of this matter and revisions of the method of operation should be made.

At the present time the Division of Water Rights is considering the issuance of the permit for the use of the Anderson Dam now under construction at the Gorge.

This reservoir will probably completely regulate the flow of the Coyote River. It is to be assumed that a condition to be incorporated in the permit will require the recognition of prior rights of the lands within the Central District.

It is highly essential that the plan of operations of the reservoir be adequate to protect the Central District.

I would like to make the following recommendations.

(1) A review should be made of the legal situation to prevent the Santa Clara District from acquiring prescriptive rights to the waters of Coyote River which it has withheld from the Central District.

(2) A study should be made of the records to see if any or how much water has been withheld from the Central District since the first Coyote Reservoir went into operation and that some means be provided for restoring this deficit, if any is found.

(3) That a plan of operations of both reservoirs should be submitted to the Central District and that the plan be approved by the Division of Water Rights.

(4) That records of flow be kept and copies given to the Central District promptly.

(5) That in case the Santa Clara District is unable by any plan of operation to protect the rights of the Central District, some other method of inducing percolation will be adopted. It may be possible to establish percolating basins in the river channel or to divert water south of the apex of the Coyote Cone or some other method.

(6) As a last resort, in the event that it is impossible to come to a satisfactory agreement with the Santa Clara District, I think litigation should be considered. This case is close to the litigation between the City of Lodi and the East Bay.

Very truly yours,

THM:IS

## ESTIMATED LOSSES IN COYOTE CHANNEL

### TABLE I.

### BEFORE REGULATION BY COYOTE RESERVOIR

| Year | Natural Flow | Actual Flow | Losses: Madrone to Coyote | Losses: Coyote to Edenvale | Total Losses |
|---|---|---|---|---|---|
| 1916-1917 | 67,900 | | 14,700 | 1,800 | 16,500 |
| 1917-1918 | 12,200 | | 8,060 | 1,520 | 9,580 |
| 1918-1919 | 46,400 | | 18,900 | 2,700 | 21,600 |
| 1919-1920 | 14,000 | | 10,000 | 1,430 | 11,430 |
| 1920-1921 | 56,800 | | 27,200 | 4,800 | 32,000 |
| 1921-1922 | 69,100 | | 9,900 | 2,300 | 12,200 |
| 1922-1923 | 50,700 | | 13,100 | 2,100 | 15,200 |
| Average | 45,300 | | 14,551 | 2,379 | 16,930 |

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### TABLE II.

### AFTER REGULATION BY COYOTE RESERVOIR

| | | | | | | |
|---|---|---|---|---|---|---|
| 1937-1938 | 154,397 | 151,447 | 14,366 | 20,613 | 34,979 | |
| 1938-1939 | 5,874 | 19,474 | 3,978 | 11,547 | 15,525 | |
| 1939-1940 | 74,777 | 65,420 | 8,658 | 21,919 | 30,577 | |
| 1940-1941 | 144,635 | 138,066 | +3,034 | 35,848 | | Not included in average |
| 1941-1942 | 74,639 | 76,058 | 8,699 | 15,094 | 23,793 | |
| 1942-1943 | 66,309 | 69,060 | 14,939 | 9,942 | | " " |
| 1943-1944 | 47,100 | 51,111 | 12,032 | 11,043 | 23,075 | |
| Five-year Average | 71,357 | 72,704 | 9,547 | 16,043 | 25,589 | |

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# PERCOLATION FROM STREAM CHANNELS

Rate of percolation of water through porous media varies as the area and depth of water. Using Darcy's formula we have:

$$V = K \frac{p}{h}$$

Where - V = Velocity of percolating water.

K = A constant to be determined.

p = Depth of water over percolating medium.

h = Depth of soil column through which percolation takes place.

With the same character of material lining a channel the percolation varies directly as the area covered by water.

Percolation from a channel with uniform temperature and neglecting changes in porocity due to silting or growing organisms may be computed by the following formulae:

$$p = K \times W \times V \times T \quad (1)$$

$$Q = W \times D \times V \times T \quad (2)$$

From (1) and (2) we have

$$\frac{p}{K} = W\ D\ T \quad \text{and} \quad \frac{Q}{V} = W\ D\ T$$

Where - p = percolation from unit length of channel for unit time.

W = Width of channel.

T = Time water is on unit length channel.

D = Mean depth of water.

V = Mean velocity of water.

Q = Quantity of flow.

K = Constant.

Therefore - $p = K \frac{Q}{V} = K\ A$

If the unit of time taken is one day a duration of flow tabulation will permit the computation of percolation. The area(A) can be obtained from channel cross-sections. The formula will be:

$$p = K \Sigma A\ T$$

The value of K can be determined from a determination of actual percolation.

For example - on the Mokelumne River the constant of Percolation(K) was determined as follows:

Using period October 1929 to June 1930 when percolation was measured in great detail we found p = 19.184 acre feet during a period when the total flow was 224,000 acre feet (Q). Using the cross-section at the Clements Station as typical of the river and with the flow duration table we obtained $\sum A\,T = 50755$

$$\text{Then } K = \frac{p}{\sum AT} = \frac{19.184}{50,755} = 0.38$$

On the Coyote River we have percolation measurements for long periods of time, from which constants may be computed. It will then be possible to compute percolation upon any method of release of water from reservoirs.

(39)

Santa
Espanola

Travelled 0565. 7618 page 77

1910 6.04 ft

1915 6.25 ft

1911 5.14 ft

1914 5.24 ft

1913 4.84 ft

1912 4.25 ft

COYOTE CREEK
SEEPAGE LOSS
HYDROGRAPH AT COYOTE

PLOTS FLOW IN S SEC. FT. OR OVER

300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1

2000 4 6 8 10000 12 13 14 16 18 20000 22 24 26 28 30,000 32 34 36 38 40,000

ACRE FEET

SEEPAGE LOSS.

EUGENE DIETZGEN CO., CHICAGO-NEW YORK NO. 346 C